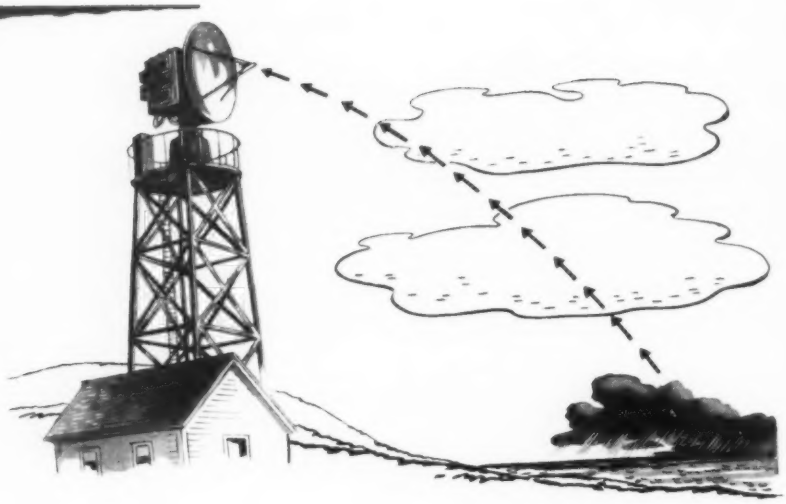
MODERN PLASTICS

JUNE 1955

Vinyl-Metal Laminates—A New Industry...Page 107

Good Design + Good Molds = Good Parts...Page 121



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As soon as defense requirements permit, airlines, utilities, farmers, and others whose operations depend on accurate weather information will have access to a new medium of accurate storm warnings. It's a detector that records with automatic cameras the behavior of storms up to hundreds of miles away . . . distance, height, course, and speed.

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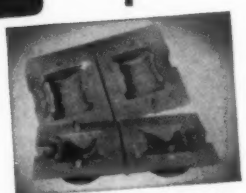
MOLDING COMPOUNDS. Structural, electrical, and chemical properties in many combinations.



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In addition to Styrene Molding Compounds, Catalin chemical products include a wide range of Urea, Phenolic, Cresylic, Resorcinol, Melamine and Styrene Resin formulations

MODERN PLASTICS*

June 1955 • Vol. 32 No 10

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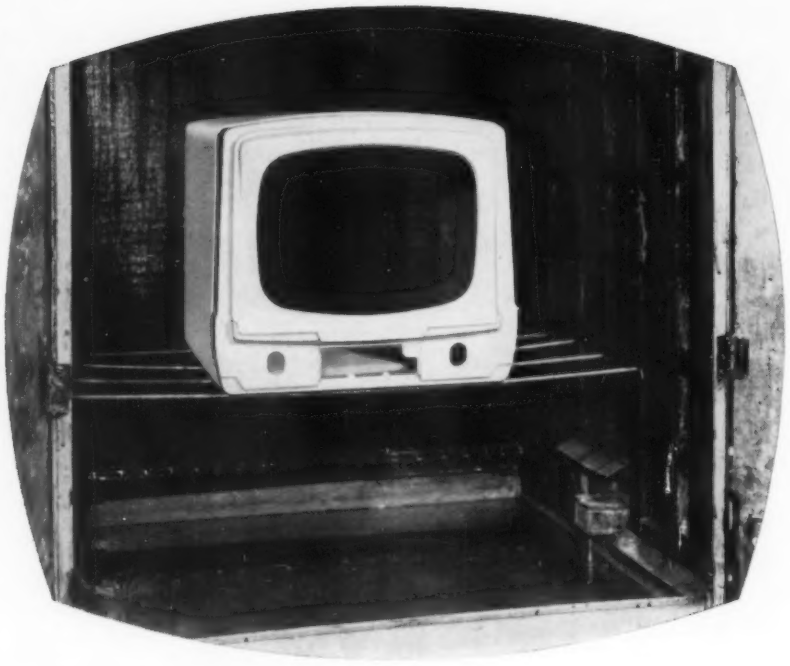
Heat- and humidity-chamber tests the ability of colorful urea TV cabinets to keep fine appearance and properties under extreme conditions.



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Hydrostatic test insures that this nylon valve body will stand surges well above service requirements.

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For example, one recent laboratory development – a new welding process for thermoplastics – saves a valve manufacturer thousands of dollars a month. Another makes it possible to control moisture in nylon molding, so that large nylon parts of uniform quality can now be produced commercially. The Materials Laboratory also made possible the first successful urea TV cabinets – a process that's now being used in the production of large, plastic cabinets and business machine housings.

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EDITORIAL

Good Reason for Confidence

From the standpoint of its relations with the field of consumer products, the mental attitude of the plastics industry is probably healthier today than it has ever been in the industry's short history . . . and with just cause.

There have been some pretty bad jolts to the ego in the past which any industry might find difficult to take in stride—any industry, that is, except the plastics industry. Here, each jolt has only served to trigger increased activity aimed at upgrading the quality of plastics consumer goods.

Today, this activity is beginning to pay off in terms of sound confidence in plastics' future in the field.

And you don't have to take the word of the plastics industry alone for it. Take the word of neutral observers whose interests are in no way tied up with those of the industry. In just two recent examples, plastics, pitted in product competition with other materials, came through with flying colors.

One was the annual Trail Blazers competition sponsored by the National Home Fashions League. Prizes were awarded to those products which represented "a genuine departure in the design and styling of contemporary home furnishings and a significant contribution toward the advancement of the industry as a whole." Of the more than 300 entries submitted in 11 different categories, the surprise winner of the furniture award was the one-piece molded phenolic drawer entered by Bakelite Co. In the floor-covering category, vinyl tile by Robbins Floor Products took honors. The winner among the wall-covering entries was Con-Tact vinyl sheet made by Cohn-Hall-Marx. Three awards out of a total of 11 went to plastics products.

In the second example, the annual "prestige" recognition given by the Toy Guidance Council to "outstanding examples of American toy production in 1955," plastics again racked up an enviable record. Of the 104 toys selected for top honors, exactly 52 were made entirely of plastics or in major part of plastics—and there were very few among the remaining half that did not use plastics to some extent.

In both of these product competitions, in which plastics were competing with *all the* non-plastics materials, the criteria for selection were quality of product and practicality of design. And in both cases, the judges based their decisions on consumer interest.

These two major instances of recognition of the industry's progress in production of top-grade consumer goods are already having a heartening effect, not only among plastics processors but at retail level as well.

The resurgence of optimism and self-assurance in the field of proprietary plastics products is indeed healthy, because it is soundly based on the ability to produce end products which can hold their own in any company.

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the M-200 . . . . . another, new, low cost, all steel granulator for all thermoplastic materials

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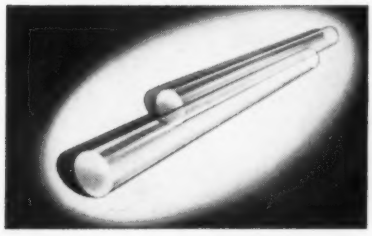
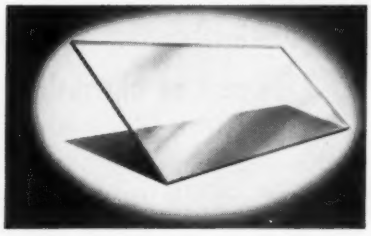
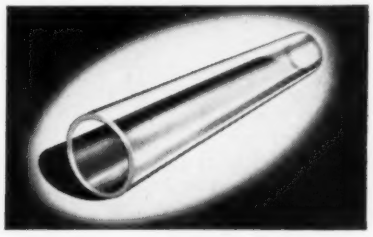


SHEETS



TUBES



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announcing 8 new benzoate esters

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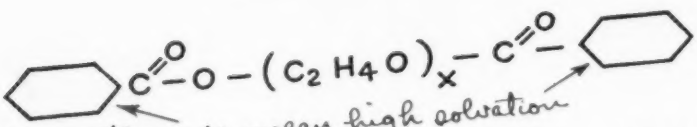

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How can they help you?

TENNESSEE announces a new series of glycol dibenzoate esters, each with special properties that may improve your product or processing. They are *light-colored, stable, mild-smelling,* and have *high-boiling* points. Their property range varies widely in freeze points, viscosity, and solubility . . . especially *solubility of water* in the higher glycol members. *Suggested Uses*: plasticizers for polyvinyl, cellulosic and phenol-formaldehyde resins. Other potential uses: lubricants, textiles, leather, adhesives and flotation.

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TYPICAL PROPERTIES OF NEW Benzoflex® ESTERS

Benzoflex Number	9-88*	2-45*	5-60	T-150	P-200	P-300	P-400	P-600
Chemical Name	Dipropylene Glycol Dibenzoate	Diethylene Glycol Dibenzoate	Ethylene Glycol Dibenzoate	Triethylene Glycol Dibenzoate	Polyethylene Glycol 200 Dibenzoate	Polyethylene Glycol 300 Dibenzoate	Polyethylene Glycol 400 Dibenzoate	Polyethylene Glycol 600 Dibenzoate
Color APHA	100	50	50	100	100	150	150	300
Boiling Pt. @ 1 mm. Hg., °C.	195-200	200-205	....	223-37	217-290	243-327	258 d.	200 d.
Specific Gravity @ 25°C.	1.129	1.178	Solid	1.168†	1.158	1.150	1.145	1.141
Freeze Point, °C.	<-35	28	70-2	47	<-35	<-35	<-35	3.8
Pour Point, °C.	-20	-25†	Solid	Solid	-30	-30	-35	Solid
Flash Point, °C.	212	232	186	237	248	258	254	264
Refractive Index @ 25°C.	1.5282	1.5424	Solid	Solid	1.5252	1.5137	1.5077	1.4984
Viscosity (cps. @ 20°C.)	215	110	Solid	Solid	101	130	167	330
Solubility, % @ 25°								
In water	insol.	insol.	insol.	0.05	0.80	0.14	0.70	0.78
Water in	0.45	1.0	....	....	2.3	8.3	16.5	32.0
Aliphatic Hydrocarbons	sol.	sl. sol.	insol.	sl. sol.	insol.	insol.	insol.	insol.
Aromatic Hydrocarbons	sol.	sol.	sol.	sol.	sol.	sol.	sol.	sol.

*—Available in commercial quantities. All others now available in development quantities only.
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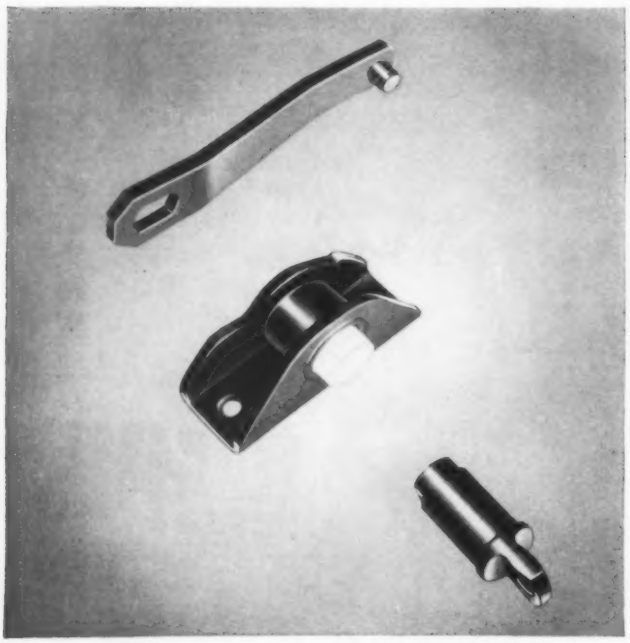
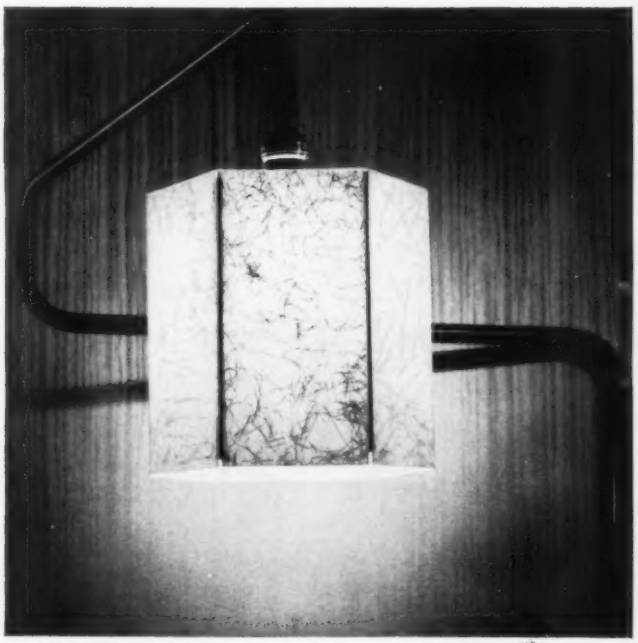
LUCITE®, in the form of revolving prisms, creates sparkling, jewel-like effects on this large outdoor sign.

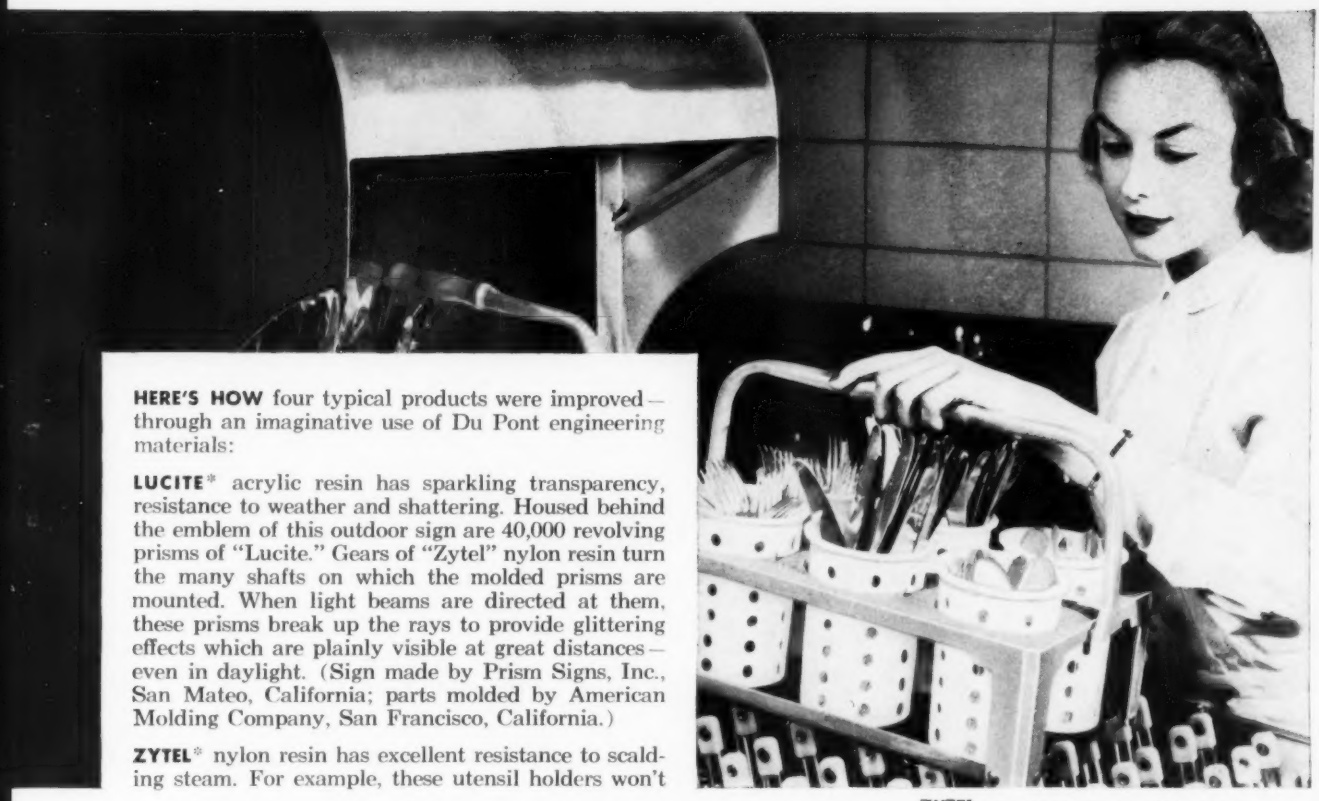
4 more examples of advanced



TEFLON®, used as a wrap-around bushing on the 1955 Mercury clutch-lever assembly. The bushing needs no lubrication, and use of "Teflon" reduced the unit cost.



ALATHON®, was chosen for this lamp shade because "Alathon" is durable, easy to clean, and can be attractively decorated. Fabrication is simple and economical.



ZYTEL®, molded as utensil holders, solves a sterilization problem. "Zytel" is heat-resistant, assures long, dependable service.

product engineering

HERE'S HOW four typical products were improved—through an imaginative use of Du Pont engineering materials:

LUCITE* acrylic resin has sparkling transparency, resistance to weather and shattering. Housed behind the emblem of this outdoor sign are 40,000 revolving prisms of "Lucite." Gears of "Zytel" nylon resin turn the many shafts on which the molded prisms are mounted. When light beams are directed at them, these prisms break up the rays to provide glittering effects which are plainly visible at great distances—even in daylight. (Sign made by Prism Signs, Inc., San Mateo, California; parts molded by American Molding Company, San Francisco, California.)

ZYTEL* nylon resin has excellent resistance to scalding steam. For example, these utensil holders won't become cracked or warped under the severe service conditions they face. The holder, molded of "Zytel," won't break if dropped. It is molded in one piece, effecting a substantial saving over the cost of making metal holders. (Molded for the Steril-Sil Company, Boston, Massachusetts, by Bolta Products, a division of General Tire & Rubber Company of Lawrence, Massachusetts.)

TEFLON* tetrafluoroethylene resin solved a design problem in the 1955 Mercury clutch-lever assembly. Because this assembly is near the exhaust pipe and in an almost inaccessible spot, Lincoln-Mercury engineers developed this .014"-thick self-lubricating bushing of "Teflon." As it needs no grease fitting, a saving is realized on each unit assembly.

ALATHON* polyethylene resin is readily fabricated by several efficient and economical techniques. The IEZ lamp shade, made of seamless, extruded tubing of "Alathon" is a good example. The shade is easy to clean, durable, and retains its shape. (Manufactured by IEZ Lamps & Shades, New York 23, New York. "Alathon" extruded by Poly Plastic Products, Inc., Paterson, New Jersey.)

Why not evaluate your own design problems in terms of the Du Pont engineering materials? For complete property information, use the coupon at right or write to: E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room 306, Du Pont Building, Wilmington 98, Delaware.

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Please send me more information on the Du Pont engineering materials checked: ☐ "Lucite" acrylic resin; ☐ "Zytel" nylon resin; ☐ "Teflon" tetrafluoroethylene resin; ☐ "Alathon" polyethylene resin. I am interested in evaluating these materials for

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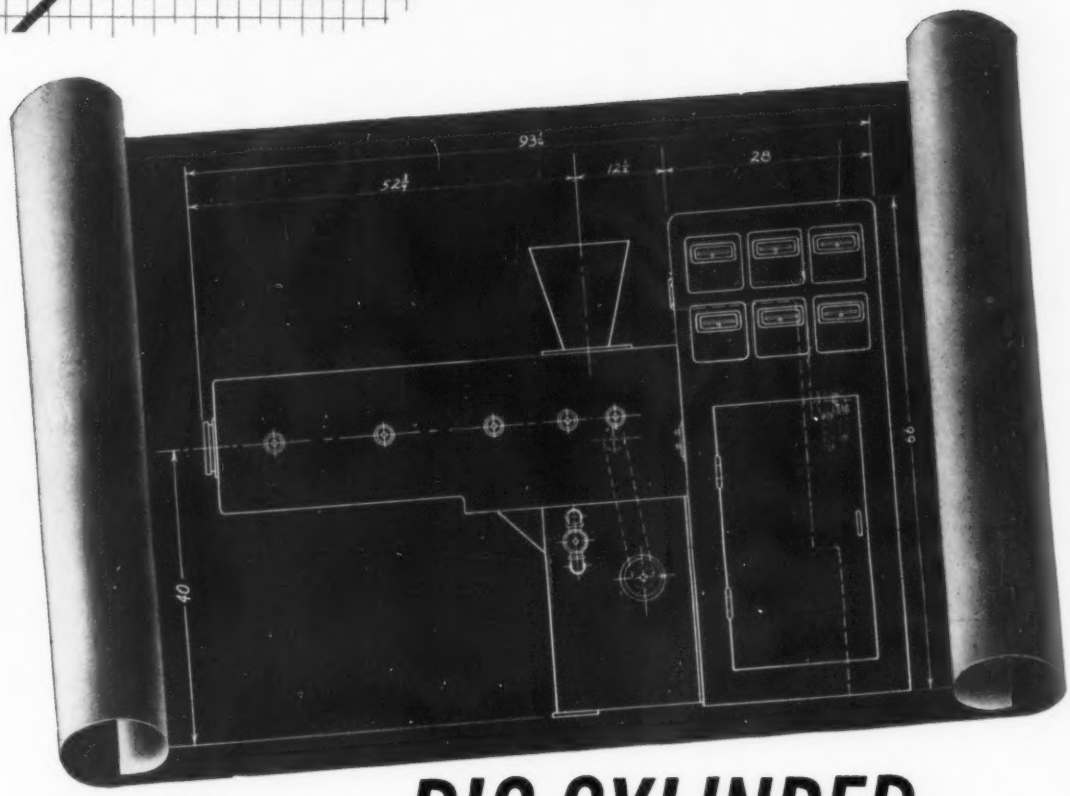

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Better awning coatings are but one of many uses for organosols based on PLIOVIC AO. Where can you use its lower compounding costs, easier processing, greater heat and light stability and excellent physical properties to advantage? For details write to:

Goodyear, Chemical Division, Akron 16, Ohio

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PLIOVIC...another quality product of Goodyear Chemical Division

Photo courtesy Cooley, Inc., Pawtucket, R. I.

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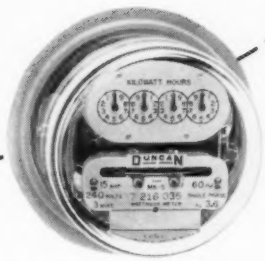
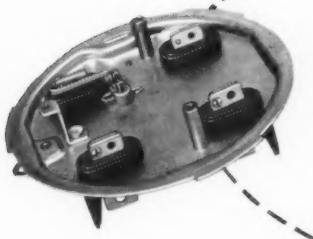
on the Value of K-K Plastic Parts?





Here's the *old* meter base, formerly used by Duncan Electric. It's a hand-assembled composite—aluminum stampings and tapped rods with moulded insulators. Many parts—much handwork—high cost!

And here's the Kurz-Kasch-moulded improvement—a 1-piece moulding with integrally moulded mounting studs and insulating bosses, with machine assembled inserts. Great improvement in corrosion and electrical resistance—less assembly—*an appreciable reduction in costs!*

How's that for a big step forward? The Duncan Electric Company finds that Kurz-Kasch moulded plastics make a fine product even better, at lower cost—and you can't improve a deal like that. Why not gamble a three cent stamp on the chance of equally pleasant results for your product? We've been serving as the moulded plastics production department of many of America's best manufacturing names for many years, and can give you the same satisfaction. Write—about *any* thermosetting parts.

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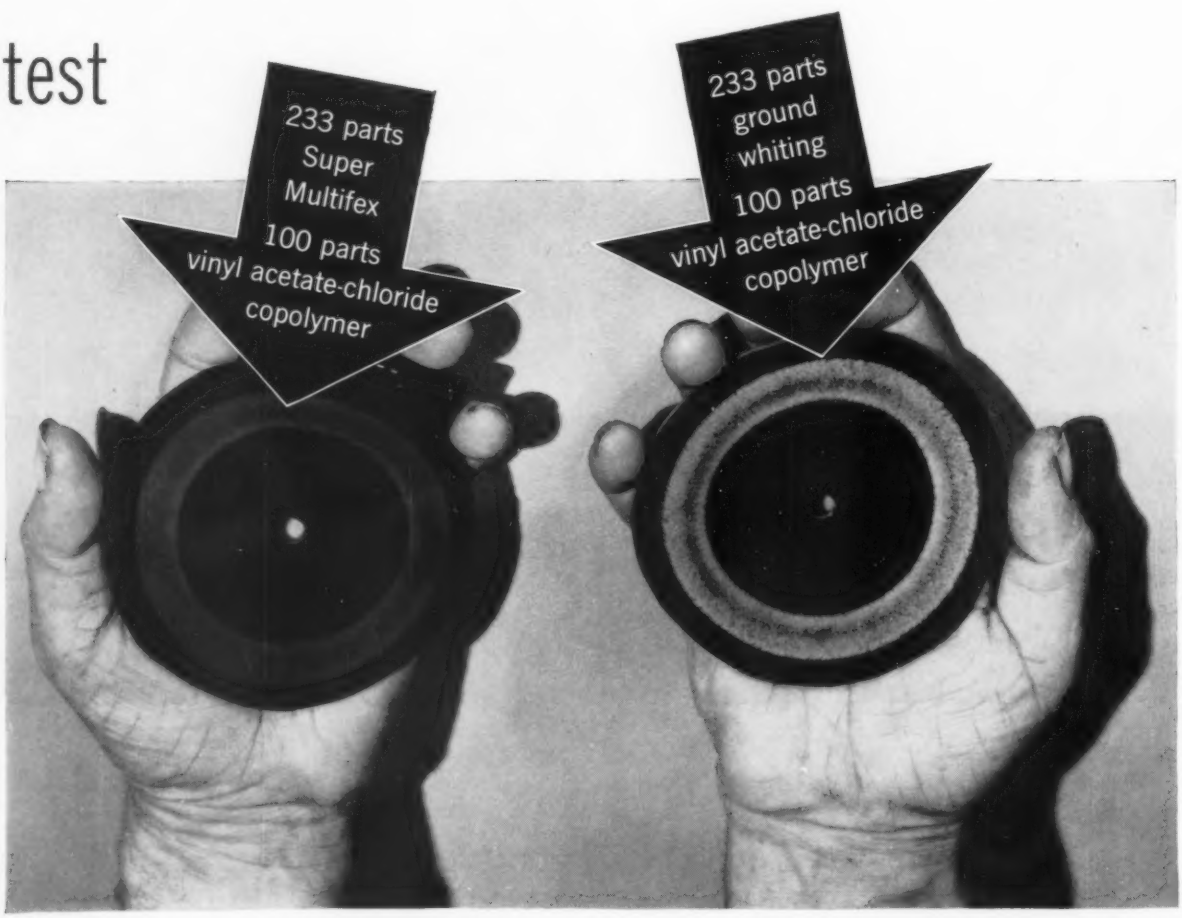
Disk with 70% Super Multifex® loading wins abrasion resistance test

Look at these two vinyl disks, shown after they received identical treatment from a Taber Abraser.

Note how the disk at left—loaded with DIAMOND's SUPER MULTIFEX—has whitened considerably less than the vinyl disk (right) loaded with the same weight of coarser filler. A comparison in the loss of weight due to the abrasion clearly showed that the vinyl compounded with SUPER MULTIFEX was superior in abrasion resistance to the vinyl containing the ground whiting.

Vinyl compounds highly loaded with this ultra-fine particle calcium carbonate show less whitening on bending and scratching. SUPER MULTIFEX has a very uniform particle size —about 0.03 microns—and a double coating with two different agents to aid its dispersion.

Your nearby DIAMOND sales office can show you money-saving formulas and detailed cost comparisons. Or write DIAMOND ALKALI COMPANY, 300 Union Commerce Building, Cleveland 14, Ohio.



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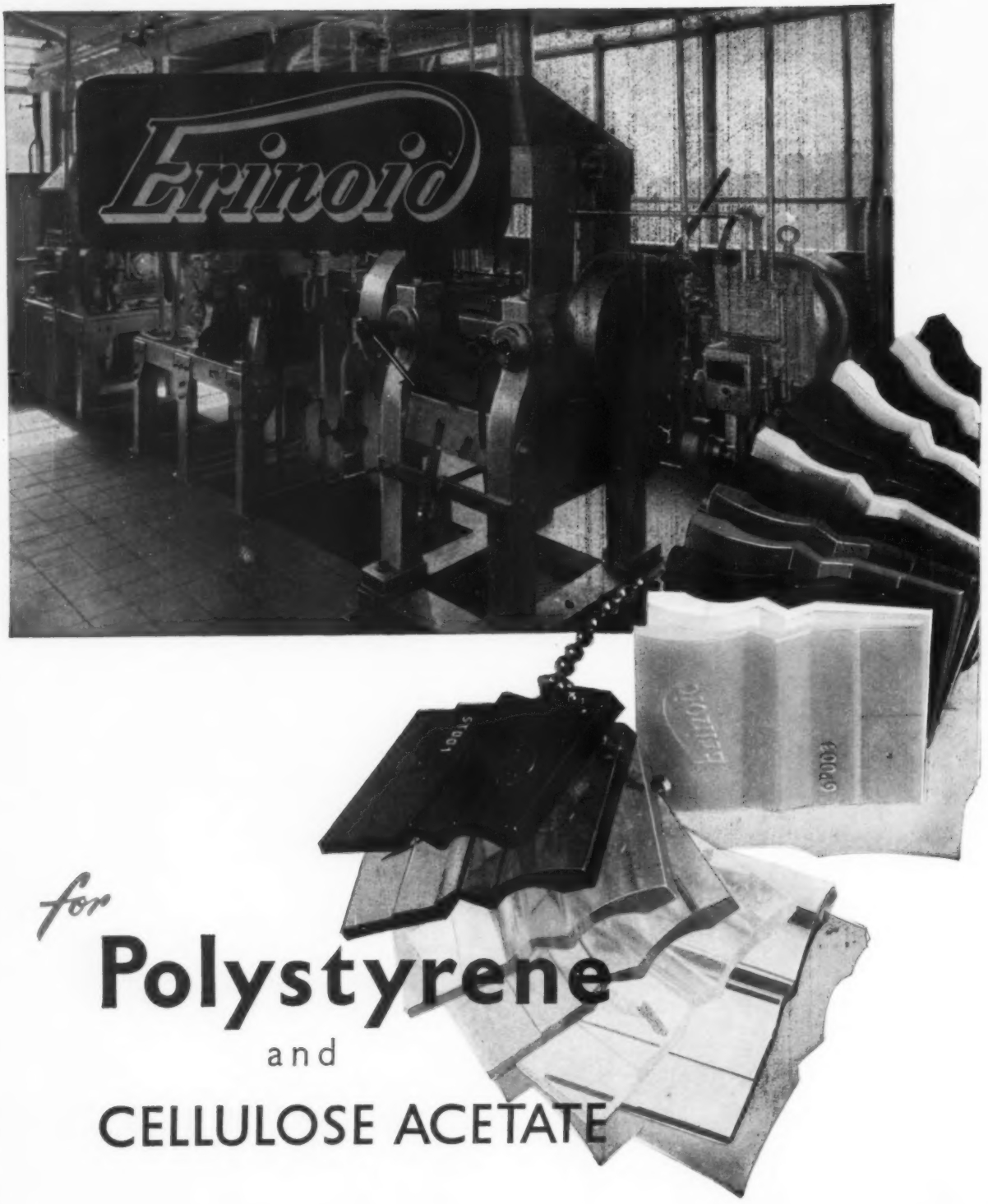

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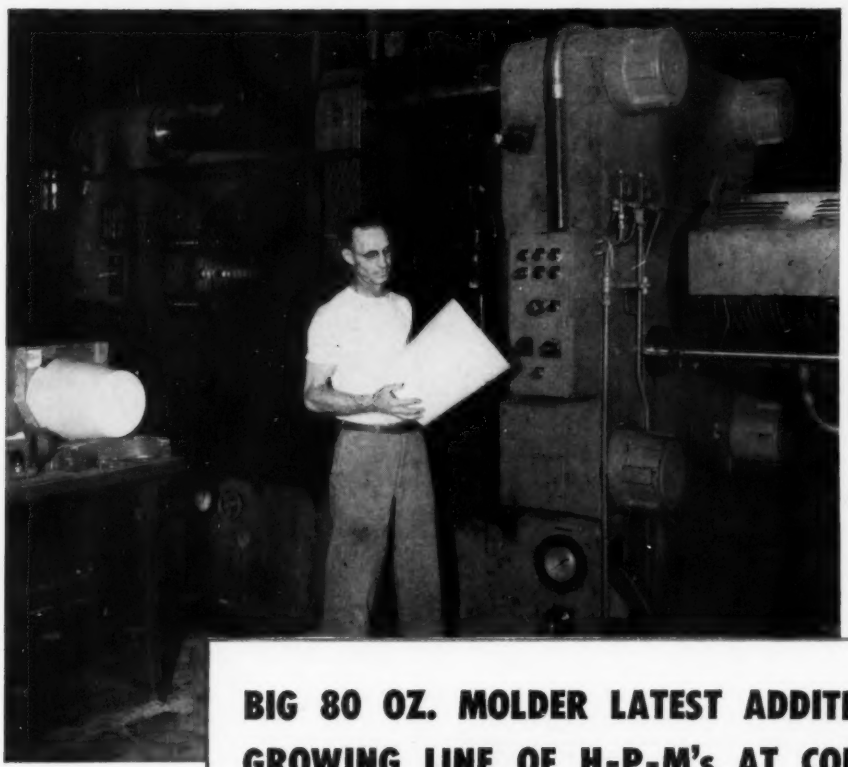
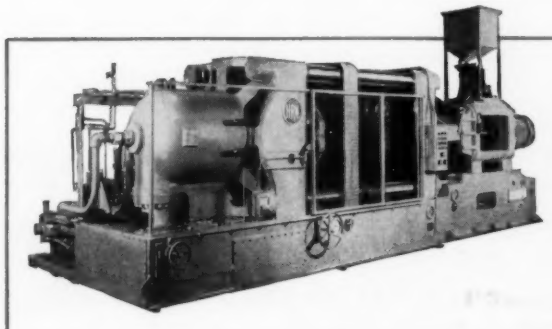


Columbus Plastic Products
Columbus, Ohio
Manufacturers of Lustro-Ware

BIG 80 OZ. MOLDER LATEST ADDITION TO A GROWING LINE OF H-P-M's AT COLUMBUS PLASTICS

These big polyethylene waste baskets are typical of the big area, deep parts being molded on H-P-M injection machines. George Kelly, General Superintendent of Columbus Plastic Products says — "Our big H-P-M is doing a real job on this big basket. We're running 'round the clock and rejects are negligible." New H-P-M injection molding machines feature large injection plunger diameters to accommodate full capacity polyethylene shots . . . plenty of stroke for deep drawn parts . . . large mold areas for big molds. They're fast and rugged with straight line hydraulic mold clamp . . . high injection speeds . . . with plasticizing capacity for the "big" shots at speeds never before possible. Accurate weigh feeders assure quality production with minimum scrap. A look around will convince you that more and more molders are turning to H-P-M. It's the most complete line of equipment in the 6 to 400 oz. field. Get the facts today—write for Bulletin 5406.



HPM

THE HYDRAULIC PRESS MFG. CO.

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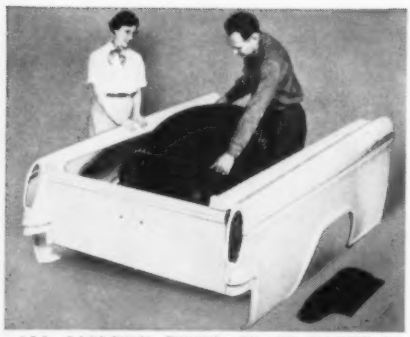
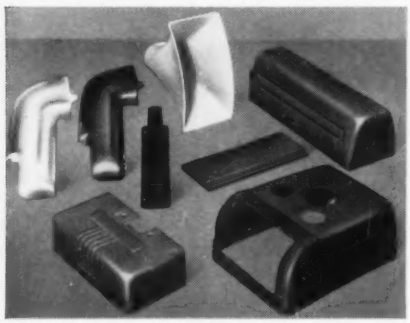
Presses for Every Pressure Processing Application

BOB MORRISON and Hal Lathrop, company executive, inspect a truck spare-tire carrier, one of many parts made with HETRON resins at Molded Fiber Glass Body Co., Ashtabula, Ohio.



ALL MOLDED FIBER GLASS PARTS for this pickup are molded by the Body Co., and all use HETRON resin. These parts combine high reverse impact with excellent flexural strength. The ultra-smooth "showroom" surface will take a baked-on alkyd finish without cracking or crazing.



MORRISON CUTS hand-finishing costs as much as 50% by using HETRON on parts like these. HETRON gives a glossy, well-filled surface—beautiful as is, or with a baked-on finish.

"I get the quality moldings I want—with HETRON"

says **Bob Morrison,** *President, Molded Fiber Glass Body Co.*

It's no easy job to meet the requirements of the automotive industry for reinforced polyester body parts.

But Bob Morrison is doing it. Here, in his own words, he tells why he molds with HETRON:

"To make good matched-metal-die moldings of auto body and other large parts, we find it advantageous to use a polyester with the resiliency of a semi-rigid resin, plus the flexural strength of a rigid resin.

"The resin must come through a short cure with practically no surface shrinkage. It must give us an extra-smooth, glossy surface, using the normal resin-to-glass ratio—and with a bare minimum of hand finishing and rejects.

"Then the finished part must take a baked-on alkyd finish at the customer's assembly plant, without a trace of surface crazing.

"It's worth paying a few cents more per pound for resin that gives us results like these in the finished product.

"We get this kind of quality with HETRON resins. Our cost is lower in the long run, because HETRON substantially reduces the amount of hand finishing we have to do."

Bob Morrison gets quality moldings —and so can you—with HETRON.

HETRON resins come to you with permanent, built-in flame resistance. This added bonus can be utilized to its highest degree with the proper choice of fillers.

If you need an assembly, a single part, or a molding material with properties like these, you'll save time by specifying a HETRON resin. HETRON costs a little more. But it gives you results worth a *lot* more.

You'll find technical information on HETRON® resins in your Sweet's Product Design File. Or write us today for complete technical data, and names of fabricators who can supply you with HETRON-based material.

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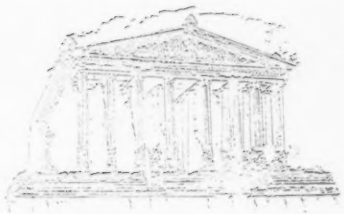
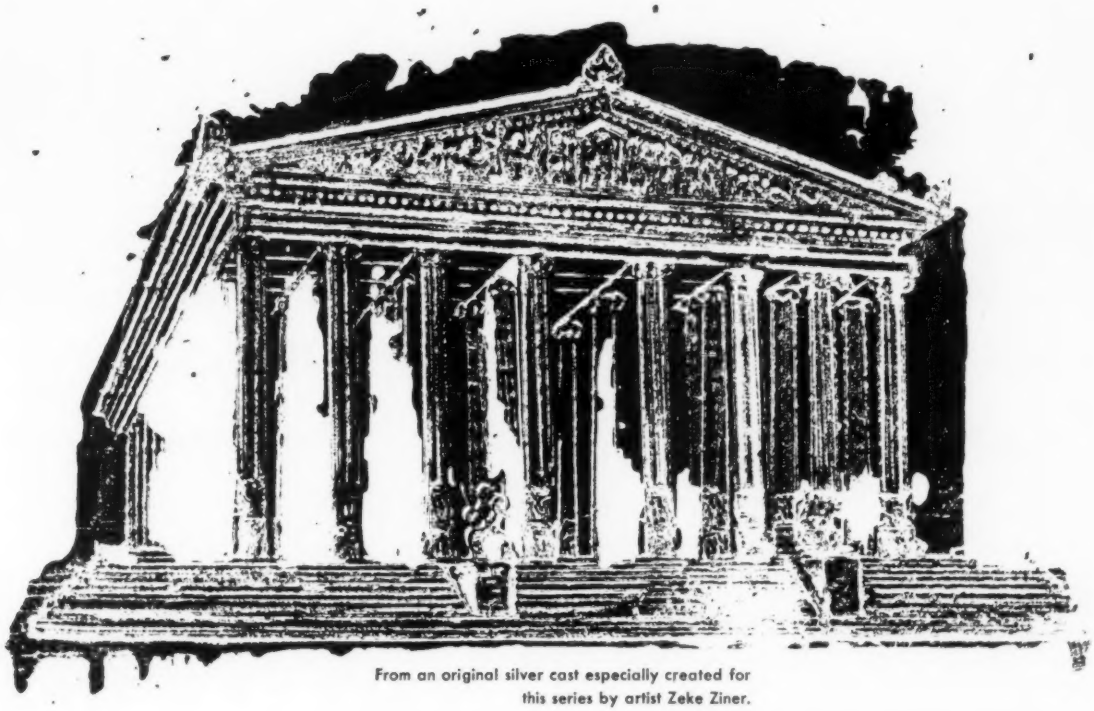


The fourth wonder of the ancient world was the largest, most elegant temple in Greece; the Temple of Diana at Ephesus. This magnificent building, with it's glistening gold and ivory statues, was 400 feet long and 200 feet wide. Supporting the roof were 127 columns 60 feet high of the whitest and purest marble obtainable. Here, thousands of worshipers came to pay homage and behold the splendor of this wonderous temple. Half completed when Alexander the Great marched by with his armies, it endured for 500 years.



From an original silver cast especially created for this series by artist Zeke Ziner.

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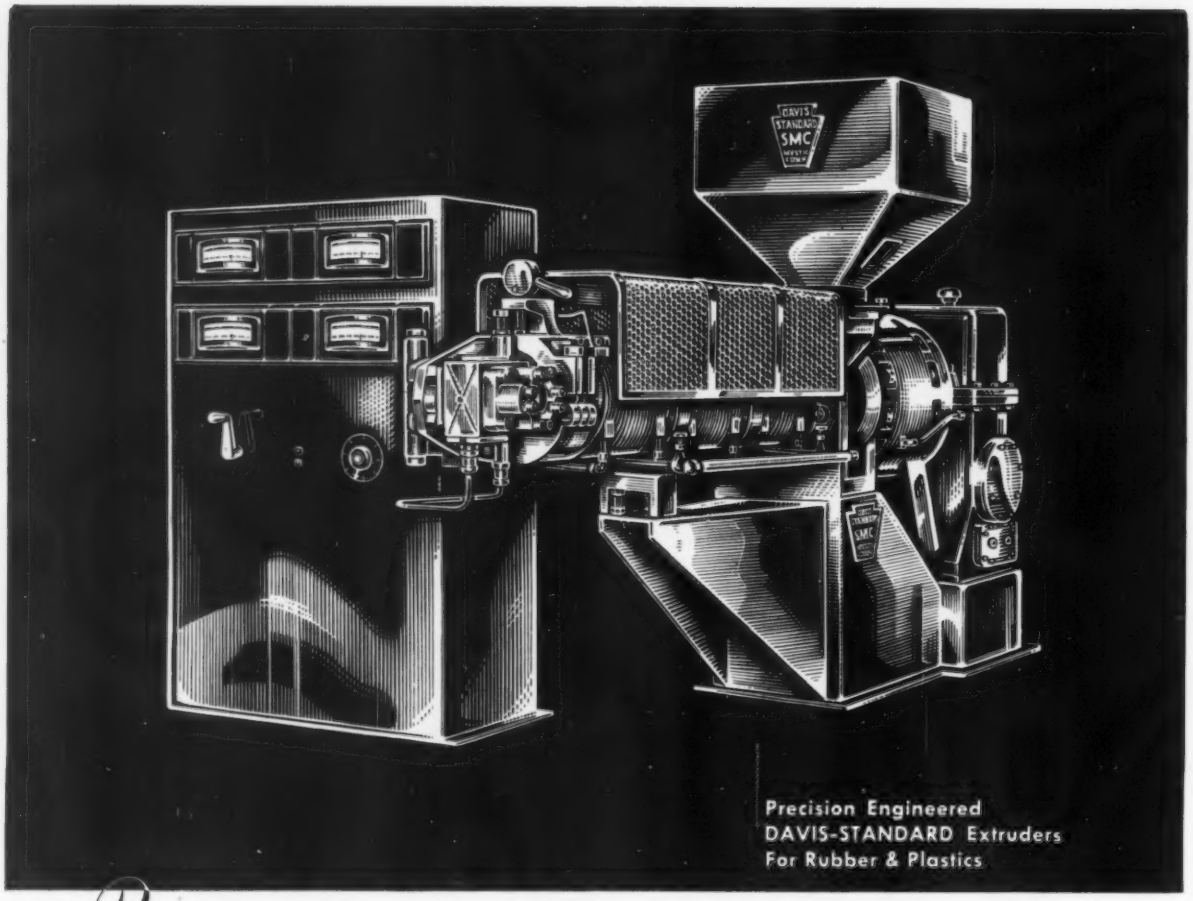

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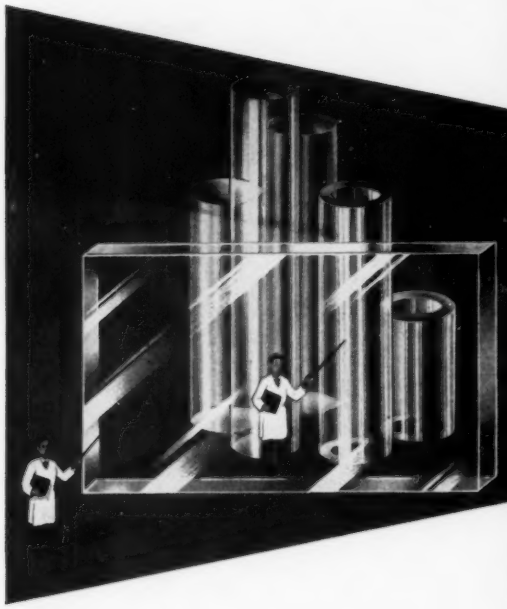

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So specify compounds containing Metasap Stearates, or incorporate them directly into your own molding compound. Metasap Technical Service is prepared to help you find the materials and mixing procedures best fitted to your production methods.

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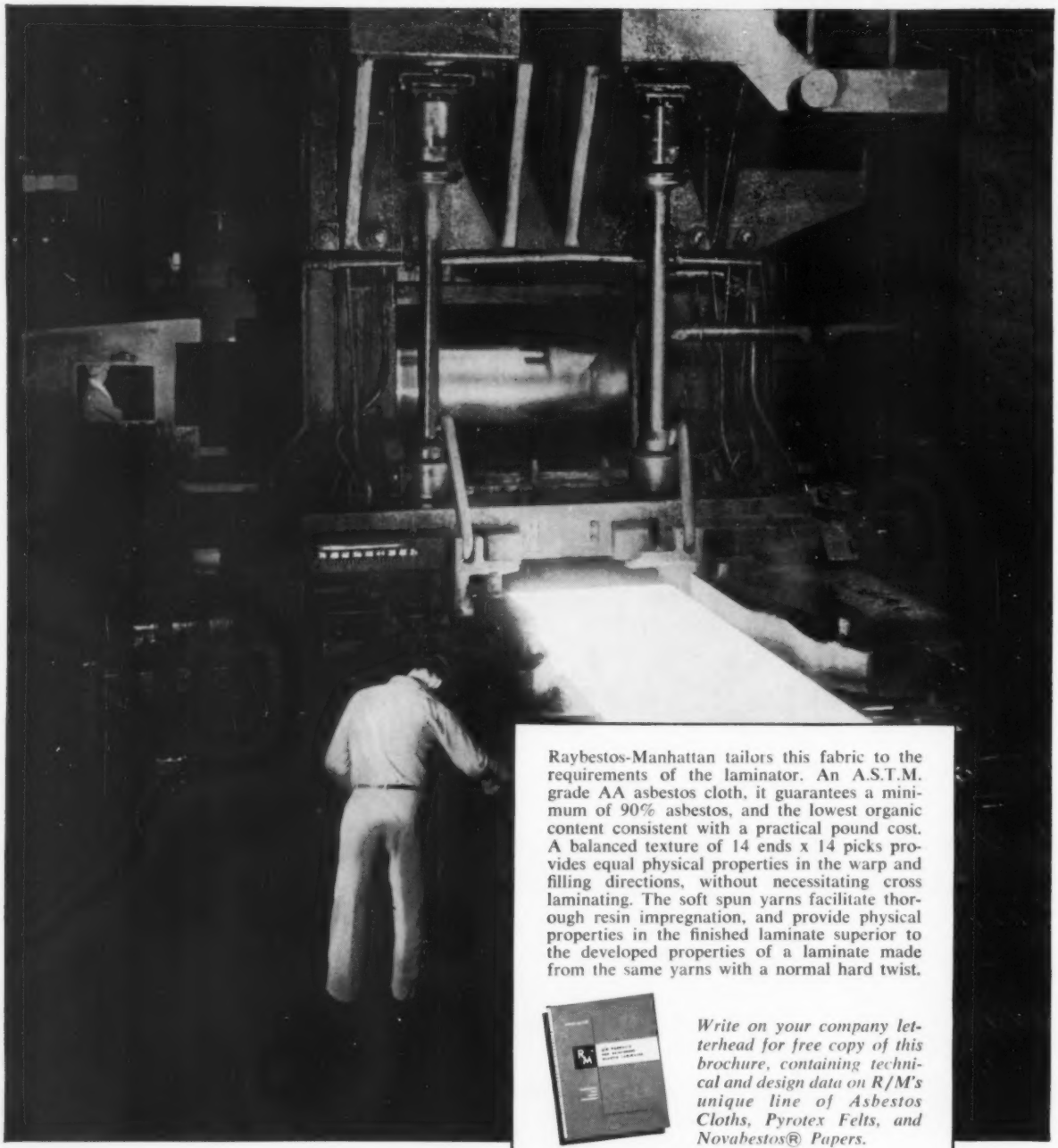

Raybestos-Manhattan tailors this fabric to the requirements of the laminator. An A.S.T.M. grade AA asbestos cloth, it guarantees a minimum of 90% asbestos, and the lowest organic content consistent with a practical pound cost. A balanced texture of 14 ends x 14 picks provides equal physical properties in the warp and filling directions, without necessitating cross laminating. The soft spun yarns facilitate thorough resin impregnation, and provide physical properties in the finished laminate superior to the developed properties of a laminate made from the same yarns with a normal hard twist.

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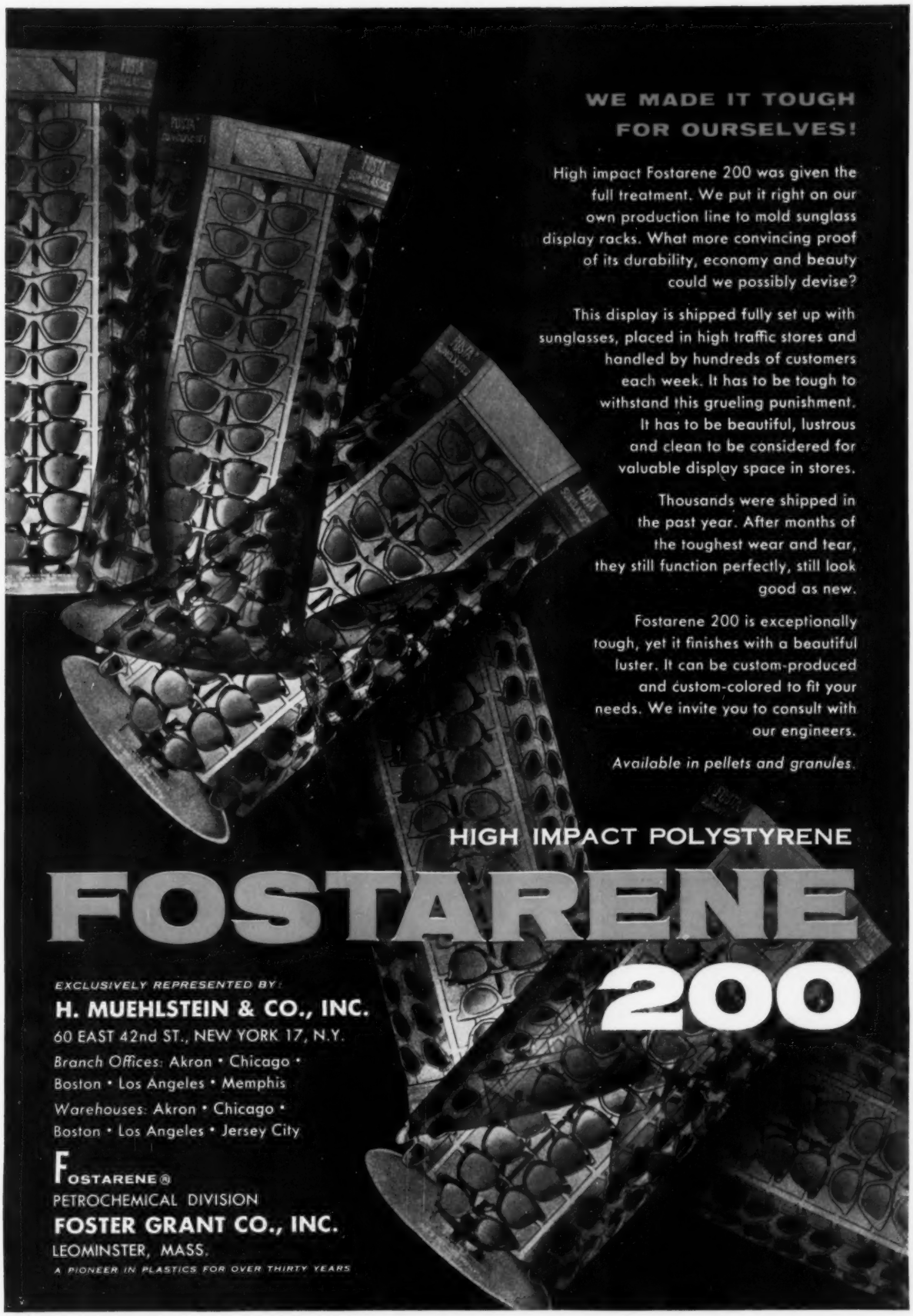
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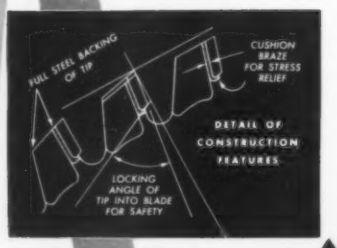
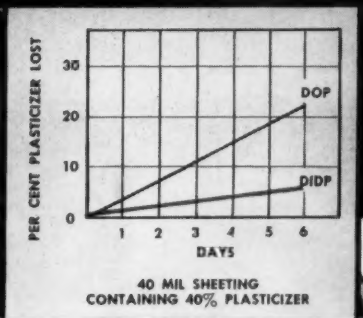


SUPERIOR VISCOSITY STABILITY OF DIDP (right) vs. DOP after one-week storage at 50° C. DIDA and DIDP also give plastisols low *initial* viscosity. All decyl plasticizers are superior to comparable octyl esters in this characteristic.



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(*butyl decyl phthalate*)

Santicizer 603, a low pound-volume cost plasticizer. Offers good flexibility, good color, low specific gravity, fusion characteristics similar to DOP. Used in film, sheeting, extrusions and plastisols.

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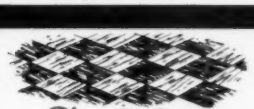
Offers excellent low-temperature flex and lower volatility than DOA or DOP. High tensile strength, good heat and light stability, excellent moisture resistance. Used in garden hose, free film and sheeting, coated fabrics.

DIDP

Low volatility, excellent retention of properties after severe heat aging, good electrical properties, superior plastisol viscosity stability. Excellent resistance to extraction by soapy water. Used for thin films, upholstery materials, wire compounds, plastisols, floor tile.



S-602

(*iso octyl iso decyl phthalate*)

Santicizer 602 offers good softening efficiency and resistance to soapy-water extraction, high alkali resistance, lower volatility than DOP or DIOP (other properties comparable). Used for floor tile, plastisols, film, sheeting, coated fabrics.

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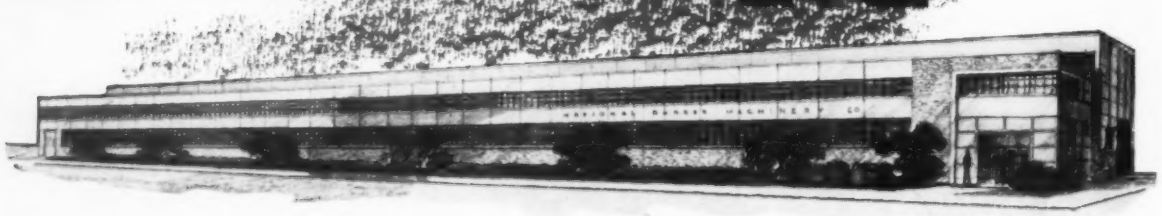


for

EXTRUDING MACHINERY

THAT OFFERS THE PLASTICS INDUSTRY

More extrusion pounds per hour

Higher quality extrusions

Lower maintenance

Greater flexibility

Easier machine operation

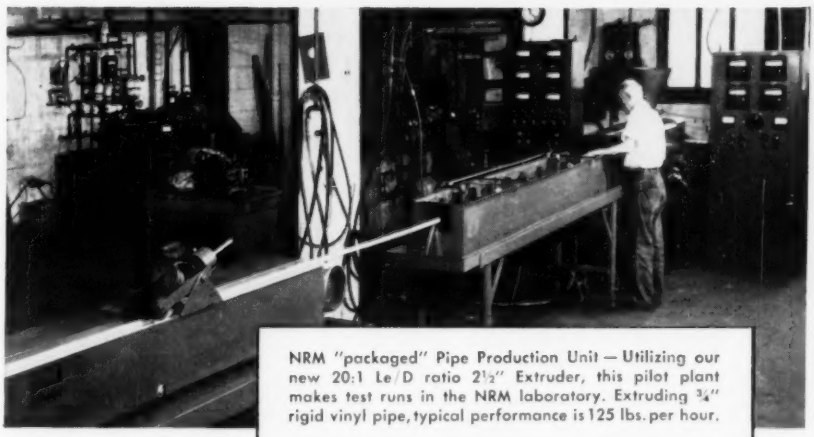
NRM 2½" 20:1 Le/D Ratio Electrically Heated Thermoplastics Extruder

Here's why . . . .

2396

CONTINUING RESEARCH AND LABORATORY DEVELOPMENT ASSURES MEETING YOUR NEED FOR ADVANCED EQUIPMENT

when you need it!



NRM "packaged" Pipe Production Unit — Utilizing our new 20:1 Le/D ratio 2½" Extruder, this pilot plant makes test runs in the NRM laboratory. Extruding ¾" rigid vinyl pipe, typical performance is 125 lbs. per hour.

The plastics industry from its very beginning has worn seven league boots. Its technology advanced so rapidly that, for a long time, machinery manufacturers scarcely recognized the challenge offered for development of completely new types of processing equipment. There was an exception, however . . .

NRM early sensed the industry's need for specialized equipment, and set up laboratory facilities in which to develop, test and perfect plastics processing machinery to meet these specialized needs. The rest of the story is history. In 1940, NRM made commercially available the **first** extruder specifically designed for thermoplastics. And the long line of other important "firsts" coming from our laboratories since, has not only kept pace with the fast-moving plastics industry, but has often helped it to move even faster.

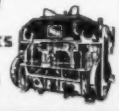
Today, NRM's research and development is practically an industry in itself, with laboratories being maintained at both our Akron, Ohio, and Clifton, N. J., plants. Full staffs of engineers and technicians, working with latest equipment, devote their whole time to improving present NRM machinery designs, or developing **new** designs where these are needed to assist the industry in working profitably with both new and conventional plastics. But improvement and development of NRM equipment is not the only activity at our laboratories . . . these extensive research facilities are also available to assist the plastics industry direct . . .

NRM engineers and technicians are always looking for "better ways" to produce plastics, and thereby make **your** work more profitable. Here, a rigid sheeting installation gets a test.

Bring YOUR Extrusion Problems to NRM

Of course our laboratory facilities are always available for demonstrating the performance of NRM equipment, but more than that, they're available to assist YOU with specific problems. Perhaps you need access to our specialized equipment in development of compounds, or in determining the type and size of extruders needed to increase the quality and quantity of your plastics production. In any case, we invite you to call on us. Working direct with you also helps US make sure that NRM Plastics Extruders and equipment are designed and constructed to do your job most efficiently, at least cost.

ENCOURAGE OUR YOUTH To CONSIDER The OPPORTUNITIES In ENGINEERING and SCIENCE



NRM

NATIONAL RUBBER MACHINERY CO.

General Offices and Engineering Laboratories
47 West Exchange St., Akron 8, Ohio—HEmlock 4-3131
EASTERN PLANT: 384 Getty Ave., Clifton, N. J.—PRescott 7-7500
SOUTH: The Robertson Company, Rutland Building, Decatur, Ga.
WEST: S. M. Kipp, Box 441, Pasadena 18, Cal.—SYcamore 4-2110
EXPORT: Omni Products Corporation, 460 Fourth Ave., New York, N. Y.—LExington 2-1320

2396

GET "20:1 QUALITY AND PERFORMANCE" WITH NRM 20:1 Le/D EXTRUDERS

Introducing...

Troytuf

DACRON BLANKET

A new and superior reinforcing material for polyester and epoxy resins

We invite you to write for samples of Troytuf Dacron Blanket for conducting your own tests

● Troytuf Dacron* Blanket for reinforced plastics molding is an extra-strong, light weight reinforcing material, ideally suited to molding with epoxy and polyester resins. It differs from most other reinforcing media in that the fibres are tightly interlocked into easily-handled blanket form by a unique needle punching operation. Troytuf has excellent deep drawing, dielectric and machining qualities which open many new, potentially high volume, product applications.

STRENGTH—The majority of Troytuf's advantages stem from the fact it consists of pure Dacron fibres, bound together mechanically without any binder or adhesive. The material has balanced orientation, its strength being equal in all directions. Pieces reinforced with Troytuf have a flexural strength greater than moldings made with glass mats. Troytuf moldings exhibit good dimensional stability and are not brittle. Also, Taber Abrader tests show Troytuf laminate has a high abrasion resistance.

WEIGHT & DENSITY—Troytuf Dacron Blanket is 20% lighter than fibrous glass, yielding products with unusually favorable weight/strength characteristics. For example, four layers of 10 oz. blanket, each 3/8″ in thickness, reduce down to 1/8″ at 85 psi. The blankets can be supplied in any specified widths to 108″.

**DuPont trademark*

IMPREGNATION—The absence of a chemical binder eliminates any need for preforming. Troytuf can be loaded with extremely high resin concentrations. It is suitable for pre-impregnation with 2-stage resins.

SURFACE—Troytuf moldings are distinguished by superior surface appearance. The fine, uniform Dacron fibres are almost completely masked by the resins which are used. Individual fibres are not apparent, except on closest inspection. The fibres are white and blend nicely with resins of any color.

FABRICATION—Moldings made with Troytuf machine easily and have good punching quality. Retention of inserts and screws for assembly purposes is excellent. Molded stock is post-formable.

APPLICATIONS—Troytuf Dacron Blanket is particularly suited for molding deep-draw pieces since it readily conforms to complicated shapes without requiring special tailoring. Outstanding dielectric and electronic transmission properties recommend it for printed circuitry, radomes and the like. Its light weight, high strength and good appearance are of importance in many general reinforced plastics applications.

SAMPLES—Troy Blanket Mills will, without obligation, supply full details and samples of Troytuf Dacron Blanket for experimental molding. *Troy Blanket Mills, 200 Madison Avenue, New York 16, N. Y.*

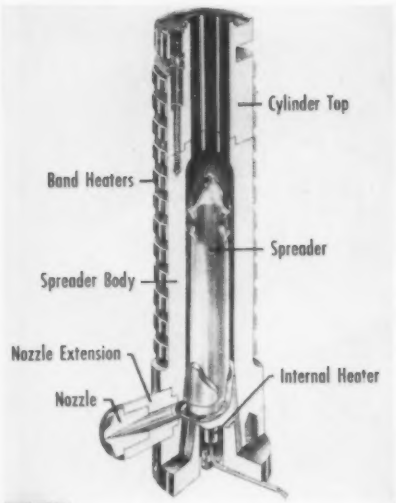
REINFORCING

Troytuf

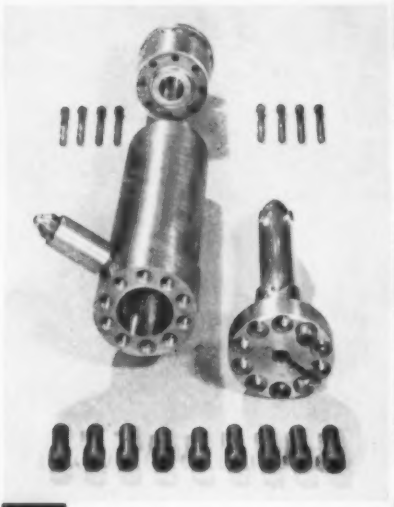
BLANKETS

LESTER Internally Heated CYLINDERS

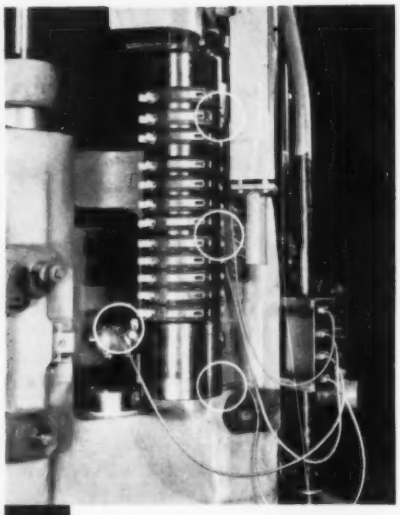
Can anyone match these advantages!



1 Nearly double the active heat contact area—proven by 10 years of record-breaking use.

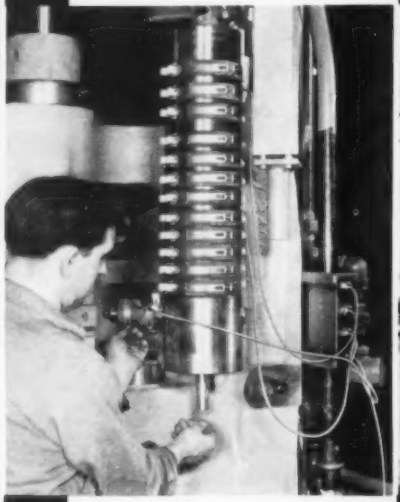


2 Mechanically indestructible, no weak ribs, slots or welds, chrome plated throughout. Water-cooled plunger.

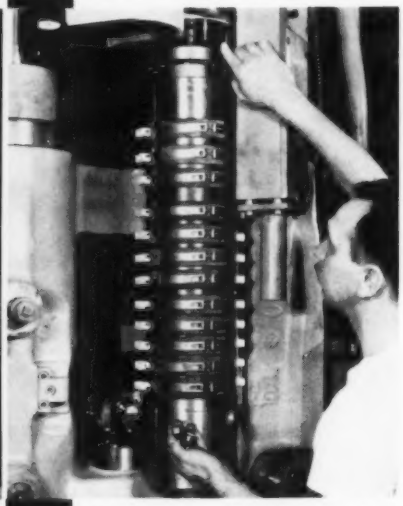


3 Four pyrometer zones—incomparably versatile with uniform heat distribution. Material feeds into full bore.

4 Frame supports cylinder and takes plunger force. Thermal expansion cannot crush the nozzle.



5 You can reach all heaters for checking or replacement without removing the cylinder.



6 You can remove a cylinder in 10 minutes—or clean it on the machine within 2½ hours.

The Internally Heated Cylinder is standard equipment on all Lester 4, 8, 12, 20 and 48 ounce machines. Write for complete specifications.

LESTER INJECTION MOLDING MACHINES

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Detroit . . . . . M. R. Tenenbaum
Chicago . . . . . J. J. Schmidt
Cleveland . . . . . Don Williams
Coral Gables . Morton Machinery Sales
Cincinnati . . . Index Machinery Corp.
Los Angeles . . . . Machinery Sales Co.
St. Louis, Milwaukee . . . . A. B. Geers
Providence . . . . Sydney W. Lohman

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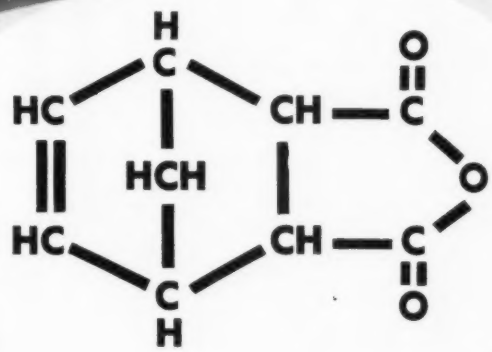
Basle, Switzerland . . . . Hermann Walti

distributed by LESTER-PHOENIX, INC., 2621-O CHURCH AVENUE • CLEVELAND 13, OHIO

have you evaluated

NATIONAL "NADIC" ANHYDRIDE

for polyesters, resins, plasticizers, surface coatings and similar syntheses?

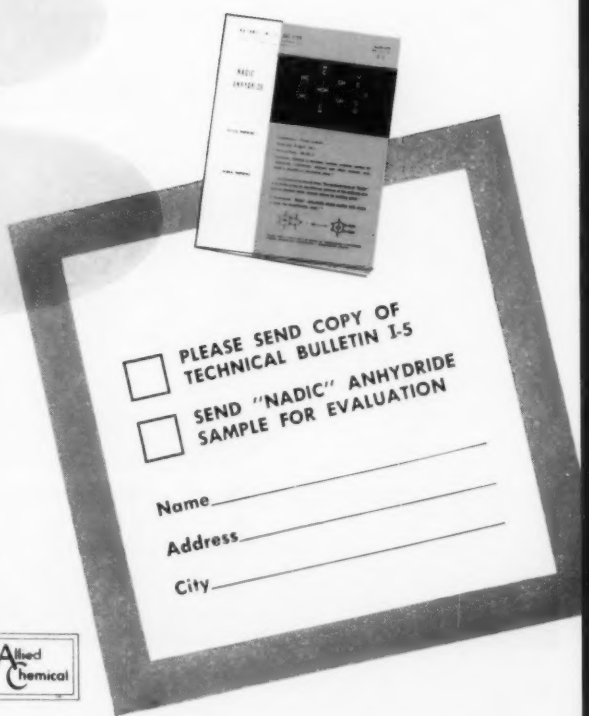


Since we announced this unique intermediate a year ago much interesting application work has been done. Its use has grown encouragingly. But the possibilities of this unsaturated dicarboxylic anhydride with a cyclic structure are far from completely explored.

Have you considered how you can capitalize upon its reactive double bonds and the many opportunities for cross linkage? We will be pleased to cooperate fully with those whose work may lead to expanded commercial use of "Nadic" Anhydride.

WRITE FOR TECHNICAL BULLETIN I-5

This 12-page digest of the properties, reactivity and suggested uses of "Nadic" Anhydride also includes a list of 68 literature references. It should be a helpful springboard to progress on current uses and future applications. A copy will be sent without cost or obligation.



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ALLIED CHEMICAL & DYE CORPORATION
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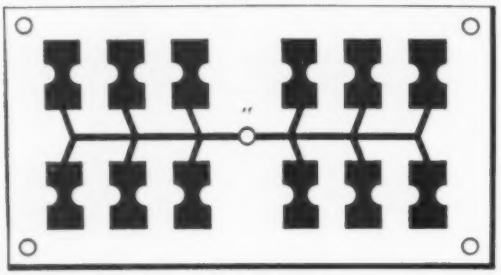
Hot Runner Molds - Smaller Machines
Compare Cost Saving — be Ahead of Competition

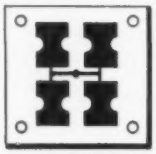
You can save on MOLD COST

Average Mold Cost $5000



Delivery time 10 to 12 weeks

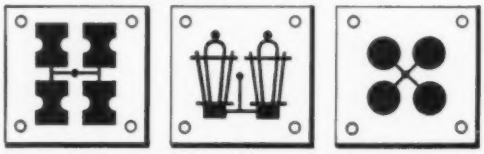
Small Mold Cost $1750



$3250 saving

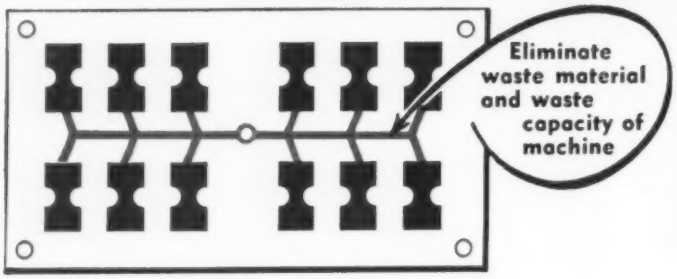
Delivery Time 4 to 6 Weeks

OR BUY 3 MOLDS - 3 ITEMS



for approximately the same investment

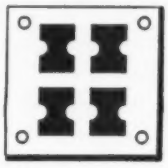
You can save on MATERIAL and LABOR



REGULAR TYPE GATING

Sprue and Runner often weigh as much or more than molded article

Hot Runner Molds—large or small



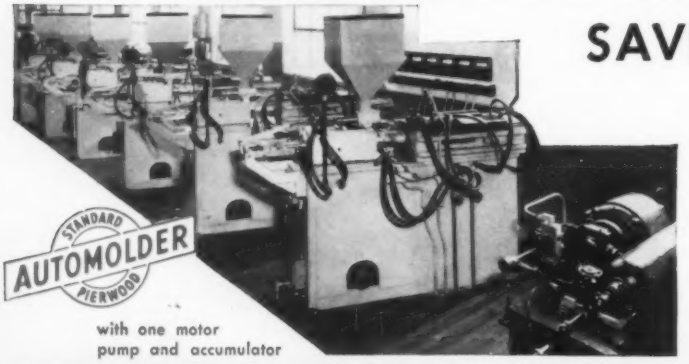
HOT RUNNER

Modern - Efficient
Economical
Material Saving
Labor Saving
Production Increase

NO SPRUE OR RUNNER

and made for ANY size machine

You can save on OPERATING COST



with one motor pump and accumulator

SAVINGS...

LABOR	1 OPERATOR ~~6 OPERATORS~~
POWER	2 15 hp MOTORS ~~6 15-20 hp MOTORS~~
MAINTENANCE	~~$~~ ¢

Cost of operating 6 machines unbelievable figure of less than 50 cents per hour per machine

BUILT BY **STANDARD TOOL COMPANY** 83 WATER ST., LEOMINSTER, MASS.

DESIGNERS AND BUILDERS OF MOLDS FOR PLASTICS FOR FORTY-THREE YEARS

Australian Plant, Standard Tool Co. (of Australia), PTY. LTD., Sydney

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The "Dutch Boy" team gives you clear, bright colors, economy.

How to team up "Dutch Boy" Plasticizers and Stabilizers to

Improve Quality and Cost Control in Vinyl Film

Pair up *"Dutch Boy" NL F-21* and *"Dutch Boy" NL F-31* Plasticizers and you can develop outstanding and inexpensive 4-8 mil film compounds.

The *NL F-21* gives you the high degree of low volatility needed for long life. The *NLF-31* establishes excellent low temperature flexibility, drape and hand. The combination is highly efficient and completely compatible...has good inherent light stability and aging characteristics.

Heat Stabilize according to stock

In translucent stocks, use *"Dutch Boy" Stabilizer Plumb-O-Sil C.* Its drying action pulls the system together, prevents spewing, bleeding or tackiness. It is specially treated for ease of dispersion . . . goes well with anything you add.

Plumb-O-Sil C preserves true colors . . . does not react chemically with dyes and pigments. No muddied reds. No bronzed or greened blues. Its refractive index is close to vinyl chloride's: it won't dim vivid colors or reduce translucency.

In clear stocks, *Clarite* is the "Dutch Boy" Stabilizer to use. It gives you excellent light as well as heat stabilization. It also provides useful lubrication.

To amplify this information . . .

Call on National Lead's technical staff. They will be glad to suggest typical formulations . . . incorporation methods, provide other details.

To learn about other equally useful "Dutch Boy" Plasticizer-Stabilizer combinations, write for our 12-page, condensed catalog, " 'Dutch Boy' Chemicals."

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NEW, DIFFERENT, DEFINITELY SUPERIOR...

PITTSBURGH 508 PREFORM ROVING

All of our molding customers who have tried Pittsburgh's new #508 roving report excellent results. That's because PPG #508 really "outpreforms" other known types of roving in producing consistently better preforms.

PPG #508 Preform Roving is definitely superior because it has been treated by a special sizing process to insure better chemical and mechanical bond between glass fibers and molding resin. Results: consistently high quality moldings, lower scrap rate, faster preforming.

Check out PPG's new 508 Preform Roving on your own molding jobs and see the difference. You can get complete information on standard packages and available sizes by simply contacting our executive offices or our district sales offices in Chicago, Cincinnati, Cleveland, Detroit, Houston, New York, Philadelphia, St. Louis or Los Angeles. Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.

FIBER GLASS PPG

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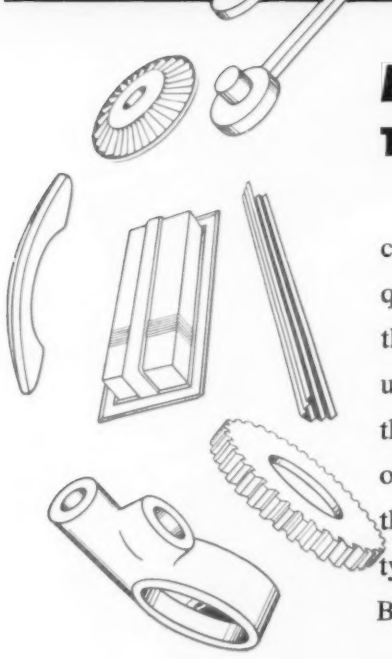
PITTSBURGH PLATE GLASS COMPANY



ENGINEERING . . .

The Basis of QUINN-BERRY Service

When you consult Quinn-Berry for molded plastics, a competent, experienced engineering staff tackles your requirements right in the planning or blueprint stage. From that point to the finished product, your molded plastics are under the supervision of these Q-B engineers every step of the way. And these steps include precision mold-building in our own machine shops by some of the finest craftsmen in the country, skilled production on modern presses, and any type of finishing required. Thus, in molded plastics, Quinn-Berry offers a complete service with undivided responsibility.

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PLASTICS

MOLDERS OF ALL TYPES OF THERMOPLASTIC MATERIALS

ANNOUNCING...

a new guide to rubber and plastics

PROCESSING EFFICIENCY

This informative new Farrel-Birmingham bulletin contains illustrations and descriptions of the widest variety of heavy duty screw-type extruding machines offered by any manufacturer.

These machines, which include plasticators, pelletizers, extruders, strainers, strainer-extruders, tubing and straining machines, and special-purpose machines, are all designed and built to suit individual needs. Their various features, as well as materials of construction, are dictated by the use intended for the machine and the particular requirements of the application.

Shown also, are diagrams of production layouts. These setups are developed by the F-B engineering planning division to help you obtain greater processing efficiency, and to reduce handling costs. Extruding machines, matched in capacity with other units so that production proceeds evenly, play an important part in these layouts.

The bulletin also includes a description of the F-B process laboratory, where you can explore the possibilities of new products and processes.

For your copy of this new bulletin, just fill out the coupon below.

FARREL-BIRMINGHAM COMPANY, INC. Ansonia, Conn.
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Please send me, without cost or obligation, a copy of your new bulletin "FARREL-BIRMINGHAM SCREW-TYPE EXTRUDING MACHINES."

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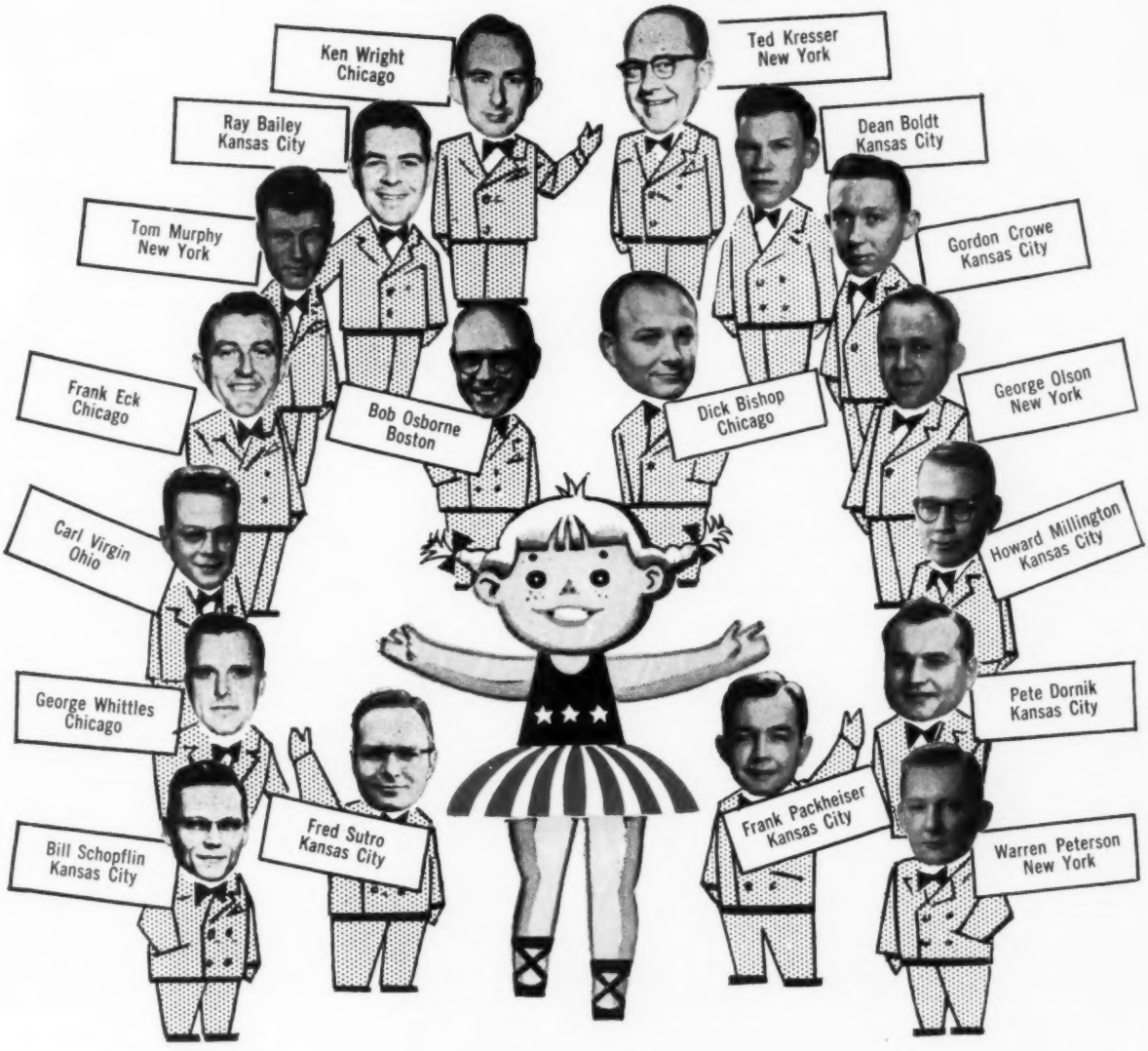
WRITE FOR IT TODAY!

Farrel-Birmingham®

FB-985

We make our own fine alloy steel ... and make it

Introducing Poly-Eth and her pals...



Pert little Miss Poly-Eth is Spencer's trademark for polyethylene. Her pals, the Spencer Sales and Technical Service team, are ready now with ideas that could help you engineer better products. Spencer's new multi-million-dollar polyethylene plant at Orange, Texas is now in production. Why not drop us a line?

Poly-Eth™ *by* **SPENCER**

SPENCER

SPENCER CHEMICAL COMPANY • 610 DWIGHT BLDG., KANSAS CITY, MISSOURI

We make our own fine alloy steel—and make it nickel-rich—to make TIMKEN® bearings tougher

NICKEL makes steel tougher. So, our steel-making specialists don't skimp on nickel in the fine alloy steel we make for Timken® tapered roller bearings. They use exactly the right amount of nickel to give these bearings the toughness they need to withstand shock and last longer. Exacting quantities of chromium or molybdenum or both guarantee uniform hardness. By using the steel industry's first direct-reading spectrometer, we exercise hairline control of each element at the precise instant of tapping the furnace.

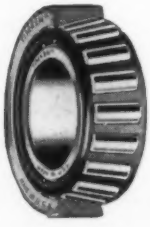
Rolling, annealing, and cooling are done with the same meticulous care. And every race and roller that goes into a Timken bearing is precision case-carburized to give it a hard, wear-resistant surface over a tough, shock-resistant core.

We've been specializing in the production of fine alloy steel for almost forty years. We're the only bearing manufacturer in the country that makes its own steel, because it's the only way we can make sure the quality of our bearing steel is just the way we want it. Steel is the heart of the bearing. That's why we insist on controlling bearing quality *every* step of the way—from melt shop to final bearing inspection. And that's why we don't skimp on the use of nickel.

To be absolutely sure of the highest performance standards in the equipment you build or buy, always specify Timken tapered roller bearings. They are made from seamless tubing or forgings by the most modern processes, under strict control. Only Timken bearings roll so true, have such quality thru-and-thru. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

Only **TIMKEN**® bearings roll so true, have such quality thru-and-thru



Giant battery cases weigh less... because they're made with DYLENE* POLYSTYRENE

BIG battery cases like the one pictured are used in communication centers and for emergency purposes. The cases were formerly made from rubber. Today these battery cases are made from Dylene polystyrene. They weigh approximately 15 pounds and will give long, dependable service.

Dylene polystyrene is being used to replace glass, metal and rubber in many industrial applications. By choosing the right type of Dylene plastic you can get such qualities as high impact resistance, low water absorption, dimensional stability, and high heat distortion resistance. Parts made from this lightweight plastic can be molded in any shape you need . . . *at low cost.*

Koppers engineers will give you technical assistance in selecting the proper Dylene polystyrene to improve your product or reduce production costs. Write to us for more information.

*Koppers Trademark

Koppers Plastics

Manufacturer: The Electric Storage Battery Company, Exide Industrial Division, Philadelphia, Pa. This 13¼" x 14½" x 19½" battery case, molded by the Mack Molding Company, Arlington, Vt., is believed to be the largest single mold shot ever made.

CHEMICAL PROGRESS WEEK-MAY 16-21

KOPPERS ®

KOPPERS COMPANY, INC.

Chemical Division, Dept. MP-65, Pittsburgh 19, Pennsylvania

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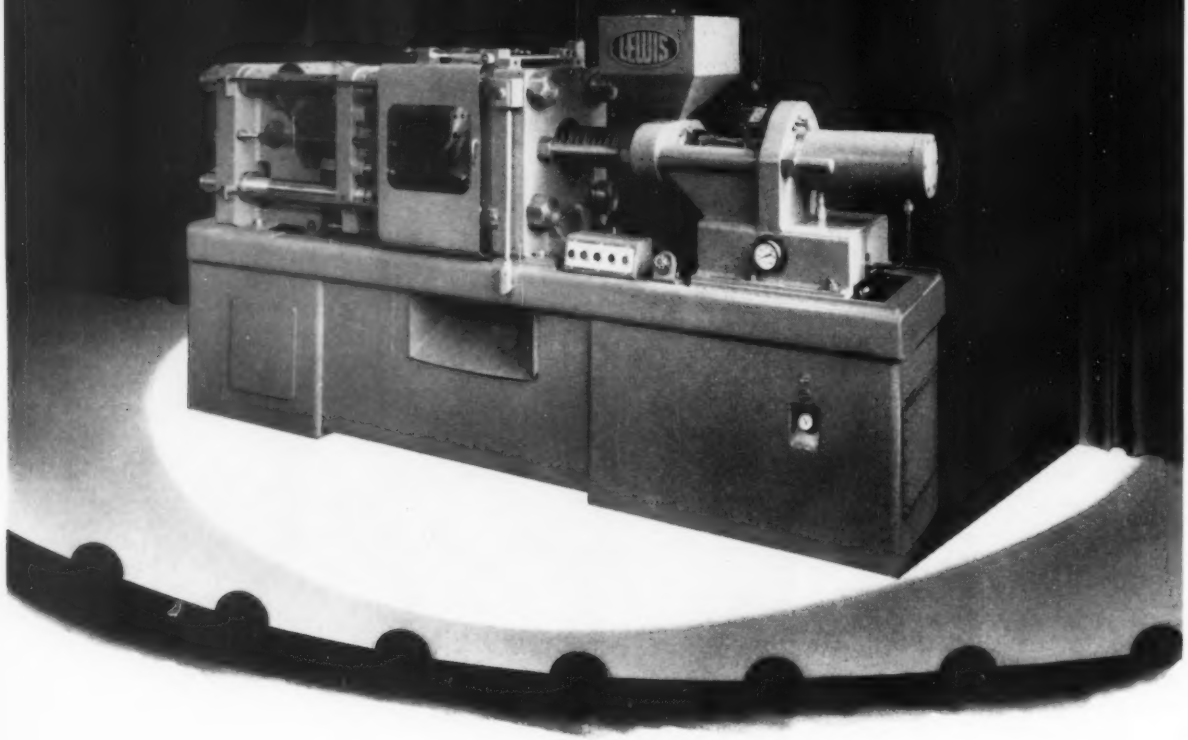
Demand Performance



Featuring the Lewis "6" Injection Molding Machine

The LEWIS Model "6" has been designed to meet injection molders' specific demands for greater economy . . . versatility . . . speed . . . and safety. This new machine can do the work of much larger units at a fraction of their initial and normal operating costs. Engineered to produce a wide variety of large projected area parts, Model "6" will plasticize up to 60 pounds of material per hour . . . mold 7-ounce shots of polystyrene at the rate of 2½ per minute.

An exclusive feature of the LEWIS "6" is the new HYDRA-LOCK clamp . . . the safest, most powerful mold clamping mechanism available today. HYDRA-LOCK utilizes only a cupful of oil to develop a 200-ton clamping pressure in tenths of a second. In addition, its design facilitates quicker, easier mold setting procedures.

For that all-important competitive advantage of high-speed low-cost production . . . specify the LEWIS "6" injection molding machine. It's engineered for demand performance.

1570-LW

Write for Bulletin 102 for complete details.

LEWIS

The Lewis Welding and Engineering Corporation

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A Totally New Binding Material Superior in its Own Right

ROYALITE "4000 QUALITY"

Royalite "4000 Quality" is not a substitute for any present material. It's *superior in its own right* —with *all* these important, practical properties:

- Warm, luxurious "hand".
- Highest dimensional stability.
- Complete pliability throughout the widest temperature range.
- Tough abrasion and scuff resistance.
- Beautiful, permanent, integral colors and grains.
- May be embossed, debossed or stamped.
- Full electronic sealability.
- Highest known compatibility with pyroxylin—other paper-making chemicals.

Use Royalite "4000 Quality" with confidence on the finest books—Bibles, prayerbooks, blankbooks, checkbooks, binders, de luxe editions.

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US RUBBER

UNITED STATES RUBBER COMPANY
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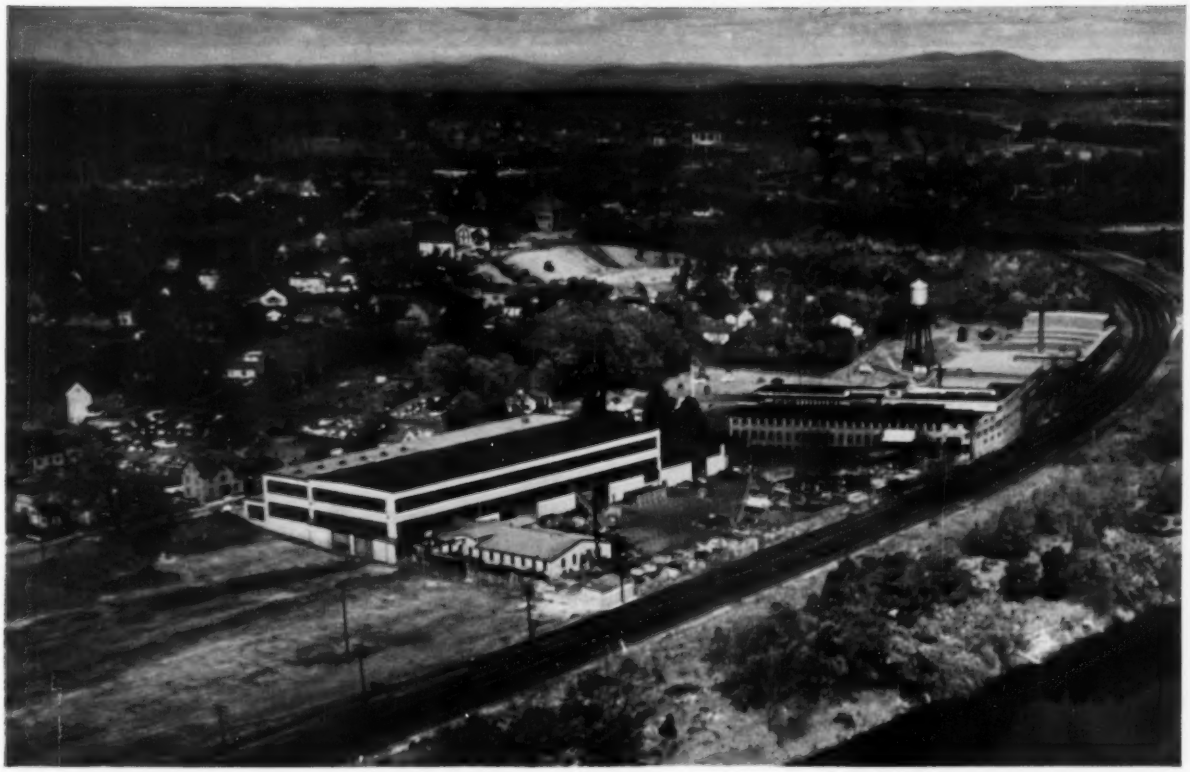

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MACHINERY INC.
NASHUA, NEW HAMPSHIRE

Located at Nashua, New Hampshire, on the banks of the historical Merrimack River and on the Boston and Maine Railroad line, this modern plant and office headquarters has developed steadily over a period of more than 60 years.

Normal industrial progress? Not exactly! This growth is the result of careful service and undivided responsibility to the Pulp and Paper Industry and more recently to the Plastic Moulding Industry as well.

We at Impco are proud to be serving these progressive industries.

IMPCO®

Designers and Manufacturers of Machinery

Sherbrooke Machineries Limited, Sherbrooke, Quebec,
manufacture similar equipment in Canada.

Whatever you make from glass fabrics—

make it better, faster, at lower cost with quality Trevarno glass fabrics

Trevarno offers a complete selection of custom and standard glass fabrics, plain, finished and impregnated—at low cost to meet your volume requirements. Trevarno fabrics are consistently uniform in thickness, weight, weave. This uniformity helps you standardize your processing operations, speeds your production, cuts your costs and gives you a higher quality product. Quality Trevarno fabrics are the result of our "one-company" operation which performs weaving, finishing and impregnating to rigid quality control standards. And quality is paramount at Trevarno.

New! Epoxy, Phenolic, Silicone and D.A.P. preimpregnated materials now available in many standard fabrics. Write your nearest Trevarno sales office for complete specifications, price information.

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Trevarno

GLASS FABRICS

"Thermex Plastic Preheaters outstanding! ...Faster cycles, fewer rejects, less maintenance"

Says **Marvin G. Johnson,** *Supt., Sperzel Co.*

Five THERMEX* Plastic Preheating Units are used at the Sperzel Company, Minneapolis, for heating toilet seat preforms. Here is what Marvin G. Johnson, Superintendent, reports on performance:

"In over fifteen years of molding we have used several types of preheaters ... but there is no doubt that THERMEX equipment is outstanding. We find faster cycles, less rejects and greatly reduced maintenance cost have given us a far smoother and more profitable molding operation."

Studies of operating figures show that rejects were reduced 33%—an important gain since rejected material cannot be salvaged. Production rates increased 33%, and maintenance costs were cut in half!

Find out how *you* can operate more profitably with THERMEX Plastic Preheating Apparatus. Call or write The Girdler Company, Thermex Division, Louisville 1, Kentucky.

*THERMEX — Trade-Mark Reg. U. S. Pat. Off.

This 7.5 kw unit can heat 6 pounds of material from 80°F to 250°F in just one minute. Power is applied automatically when the sliding drawer is closed; shuts off after a preset interval.

The GIRDLER Company

A DIVISION OF NATIONAL CYLINDER GAS COMPANY
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239 Newton Ave., Newark, Ohio • 624 So. Michigan Ave., Chicago 23, Illinois • 714 West Olympic Blvd., Los Angeles, Calif. • 1100 Craig St. East, Montreal, Quebec, Canada

Pick a number
Spin the wheel
Win a molding

Buyers who are willing to gamble on the success of their molding jobs are welcome to do so. Gambling is great *if* you win—a big payoff for a small investment. But any experienced crap shooter, horse player or five-card stud man will tell you that the odds are always stacked in favor of the house. You *might* win once, but then again, you probably won't.

Here's the point: While the cost may be a trifle higher when you deal with an established custom molder like Boonton, the element of risk is virtually eliminated. You're not gambling on material selection, on mold design, on tolerances, on delivery.

However, if you prefer to gamble in order to save a couple of pennies—and you'll rarely save more—Boonton wishes you "Good luck." You'll need it.

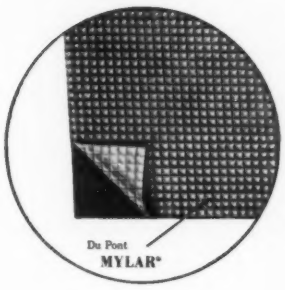
BOONTON MOLDING CO.

BOONTON, NEW JERSEY

NEW YORK OFFICE—CHANIN BUILDING, 122 EAST 42ND STREET, OXFORD 7-0155

Interior design improvements in late-model cars

made possible by NEW DU PONT MYLAR*



Style-conscious designers are achieving new beauty . . . new economies in auto-interior trim . . . with a new kind of decorative surfacing material made possible by Du Pont "Mylar" polyester film. This thin, tough, transparent film —which resists abrasion, oils, solvents, chemicals—can be metalized in a full range of subtle colors. Bonded to a backing, then embossed, metalized "Mylar" offers a rich-glinting variety of decorative side-door panel inserts, seat-welt trim, package-tray covers and kick panels. And designers estimate that the cost of these new and striking effects for auto interiors is 40% less than the material formerly used!

This new decorative surfacing material is highly resistant to abrasion. Oil and grease have no effect on it. It can be wiped clean without smearing. Other uses now in development include wall surfacings, leather goods, book covers, kitchen appliances.

Find out more about new materials made with "Mylar." Mail the coupon for new booklet and samples.

**Du Pont's registered trade-mark for its brand of polyester film.*

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MYLAR®
polyester film

DU PONT

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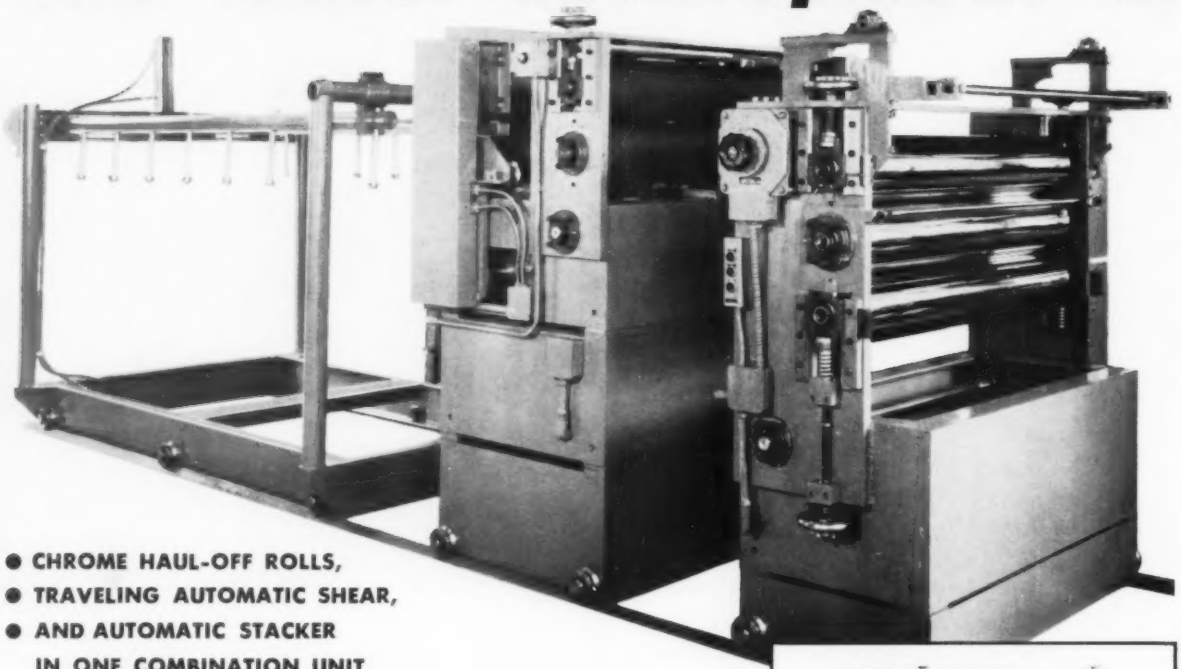
ROBBINS

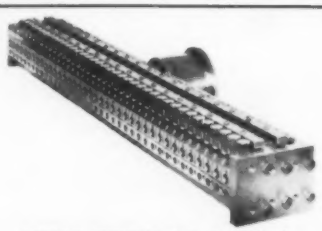
the latest development in



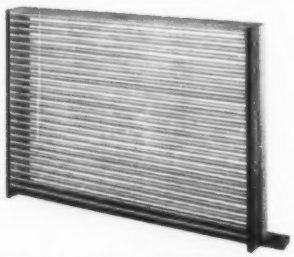
- **CHROME HAUL-OFF ROLLS,**
- **TRAVELING AUTOMATIC SHEAR,**
- **AND AUTOMATIC STACKER IN ONE COMBINATION UNIT**

This newest Robbins combination is being used for production of top quality sheeting and laminating. Units of the combination mount on base rails, and are equipped with ball-bearing rollers for easy movement. Both bottom and top chrome haul-off rolls are adjustable. Laminating rolls can be set in most practical position for any specific operation. Height of units can be varied according to type of base specified. Heat exchanger and electrical controls are also available for specific requirements. Variable speeds on all units. Used with other Robbins individual units or special attachments, this latest Robbins combination has the flexibility to meet your requirements. Robbins dies and haul-off equipment can be used with practically all makes of extruders now on the market.

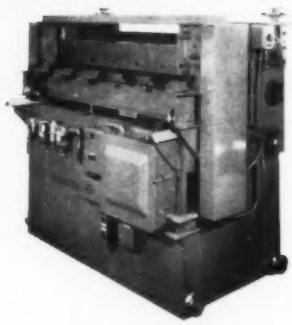
SEE ROBBINS FOR LATEST DEVELOPMENT IN RIGID VINYL SHEETING DIES.



ROBBINS SHEETING DIE—Suitable for extending high impact Styrene, Acrylic, Cellulose Acetate, Butyrate, and Polyethylene. Available in widths from 12" to 60" with gauge range of .010" to .190". Two sets of die lips, and heaters in three separate zones. Interior parts highly polished and chrome plated.



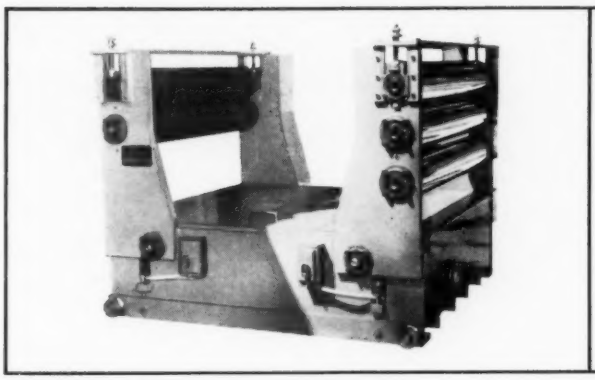
ROBBINS ROLLER CONVEYOR—This handy set of conveyor rolls is available in 3 ft. lengths and as wide as required. Can be attached between haul-off units and sheat. Frame predrilled for quick, easy mounting.



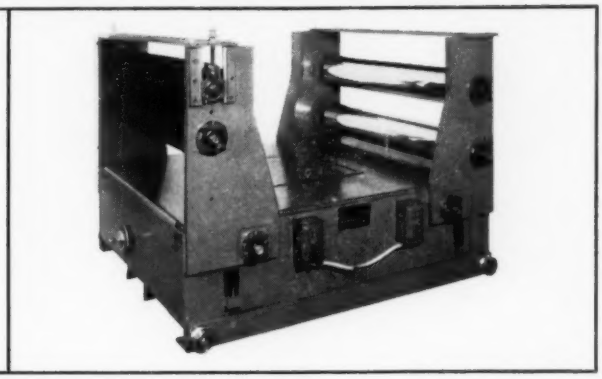
ROBBINS AUTOMATIC SHEAR—The latest development in sheet cut-off equipment. Electronic controls maintain uniform speed of the shear carriage which is synchronized with haul-off rolls and laminating rolls. Shear can be adjusted to any length cut desired and exact dimensions are maintained by photo-electric cell. Automatic scrap cut-off control cuts sheeting into 3" strips. Tension rolls and shear are powered so that proper tension is maintained at haul-off rolls with compensation for shrinkage. Trim or slitting knives are easily attached to shear. Shear can be used in combination with any Robbins two-roll or three-roll sheeting haul-off unit or adaptable to your present equipment.

ROBBINS SHEET STACKING UNIT—Adjustable to handle sheet 1' to 8' long and up to 48" wide. Stacker is mounted on base rail in combination with other units. Wind-up equipment for sheeting is also available from Robbins.

now shipping
plastic sheeting equipment



ROBBINS THREE-ROLL SHEETING HAUL-OFF—This complete unit has three super-finished, chrome plated haul-off rolls and two rubber-covered tension rolls for high impact Polystyrene, Acrylic, Cellulose Acetate, Butyrate and Polyethylene. Rolls are controlled by variable speed drive, through heavy-duty worm gear. Rolls jacketed for cooling or heating with water, steam or oil. Top chrome roll is adjustable. Can be used in combination with shear and stacking unit, or with wind-up equipment.

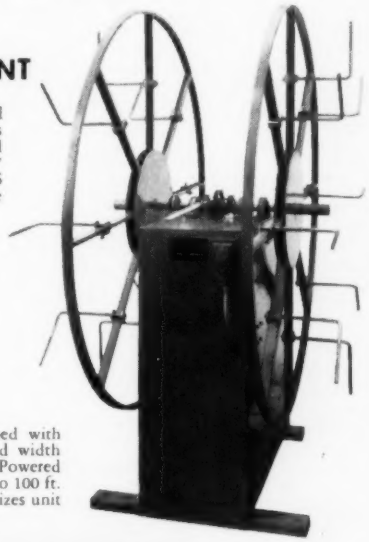


ROBBINS TWO-ROLL SHEETING HAUL-OFF — Designed to accommodate Acrylic, Cellulose Acetate, Butyrate, Polyethylene and Vinyls. Unit complete with two super-finished, chrome plated haul-off rolls and two rubber-covered tension rolls. Each set of rolls driven by a heavy-duty worm gear. Roll speed adjustable to speed of extruder. Rolls jacketed for cooling or heating with water, steam or oil. Can be used in combination with shear and stacking unit, or with wind-up equipment.

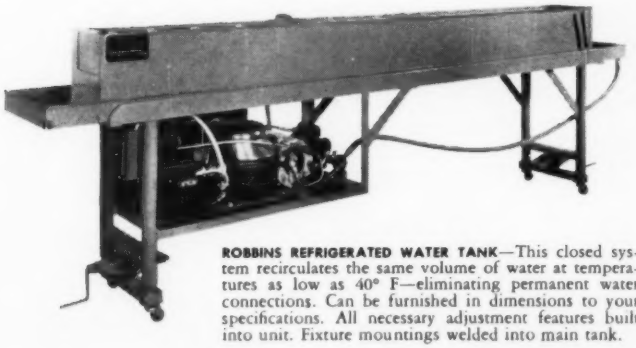
ROBBINS PLASTIC PIPE TAKE-OFF EQUIPMENT

ROBBINS has a background of experience in all phases of plastic pipe production. Offset pipe dies for producing Polyethylene, Butyrate and rigid Vinyl pipe are available in ranges from ½" to 6" dia. Other equipment (not shown) are ROBBINS Automatic Cut-Off Saw and conventional-type conveyors.

ROBBINS PIPE PULL-OFF UNIT—Equipped with four motor-driven concave rubber rolls, adjustable for ½" to 6" dia. pipe. Model also available for pipe 6" to 15" dia. (not shown). Variable drive allows speeds up to 126 feet per minute. Remote control synchronizes pull-off with extruder. Adjustable in height between 36" and 44" from floor to center line of pipe.



ROBBINS PIPE COILING UNIT—Equipped with two reels, adjustable in diameter and width to accommodate ½" to 2" pipe. Powered through variable drive for speeds up to 100 ft. per minute. Remote control synchronizes unit to speed of pipe pull-off unit.



ROBBINS REFRIGERATED WATER TANK—This closed system recirculates the same volume of water at temperatures as low as 40° F—eliminating permanent water connections. Can be furnished in dimensions to your specifications. All necessary adjustment features built into unit. Fixture mountings welded into main tank.

Robbins
never say die . . . say Robbins die

Consult **ROBBINS** Technical Service for help on your plastic extrusion problems. No obligation, of course. We specialize in the design and manufacture of *shop-tested* dies, heavy duty equipment and accessories. Write or phone today.

ROBBINS PLASTIC MACHINERY CORP.
1430 Mishawaka Street, Elkhart, Indiana
Phone—Elkhart, 2-4060

Revell PLASTIC Kits

Revell plastic hobby kits are today's *newest and hottest* premium opportunity. These faithfully recreated guns, model planes, ships, oldtime cars and horse-drawn vehicles—or, if you wish, a custom-designed model symbolizing your business or trademark—inject lively new interest into sales promotion and store displays—*and into sales!*

Action Never before has the average person been able to express his constructive urge—and see it easily realized in a flawlessly perfect model. Here is something the customer can *do*. He contributes his own "labor" in fitting together a Revell plastic quick construction kit.

Permanence *What we make with our own hands becomes part of us.* A completed Revell plastic model is a prized possession on proud display in the customer's home—a permanent association with your product, too.

Appeal *For All Ages:* Hobby Stores report a 45-55% adult-juvenile market. This means the fun of assembling and decorating replicas of grandpa's Model T, a frontier days vehicle or gun, or a thrilling ship appeals to everyone—from four to fourscore!

Write today for full details on the newest, *hottest* line on the premium horizon. Address Premium Division, Revell, Inc., Venice, Calif.

Millions say REVELL for the Best!

Revell, Inc. 4223 OCEAN PARK AVE. VENICE, CALIFORNIA

SERVICE .... QUALITY .... DEPENDABILITY

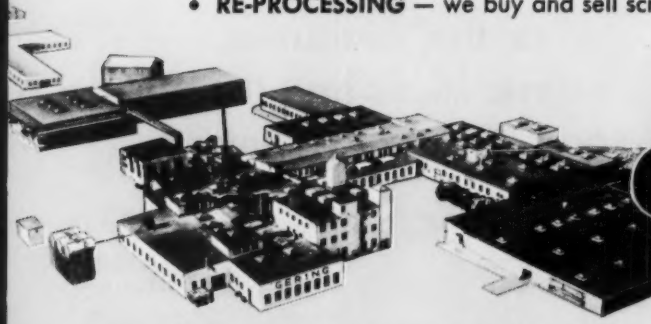
If it's **PLASTIC**

Check with GERING

Get the **MOST**
for the **LEAST**
expense!

GERING KNOW-HOW and SERVICES MADE-to-ORDER for YOU!

- **CUSTOM COMPOUNDING**
- **DRYCOL** in-plant colorant
- **S-T-R-E-T-C-H** polyethylene colorant
- **STYROMIX**
  ready-mixed and colored styrene
- **PURGING COMPOUND**
  for injection molding machine cylinders
- **RE-PROCESSING** — we buy and sell scrap
- **GER-PAK**
  polyethylene film, tubing, sheeting; also PRINTABLE surface for display packaging
- **EXTRUSIONS** — rigid and flexible
- **EXTRUDED ACRYLIC SHEET**
  low-cost, for signs and lighting; clear; colors
- **GER-FLEX** vinyl tubing
- **GER-TUBE** polyethylene tubing



"PIONEERS in modern plastics for over 30 Years"

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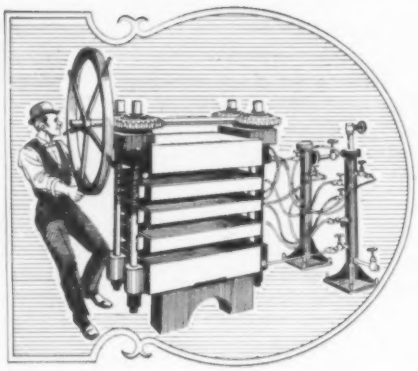


In the good old days

when grandpa molded on this screw-operated press . . .

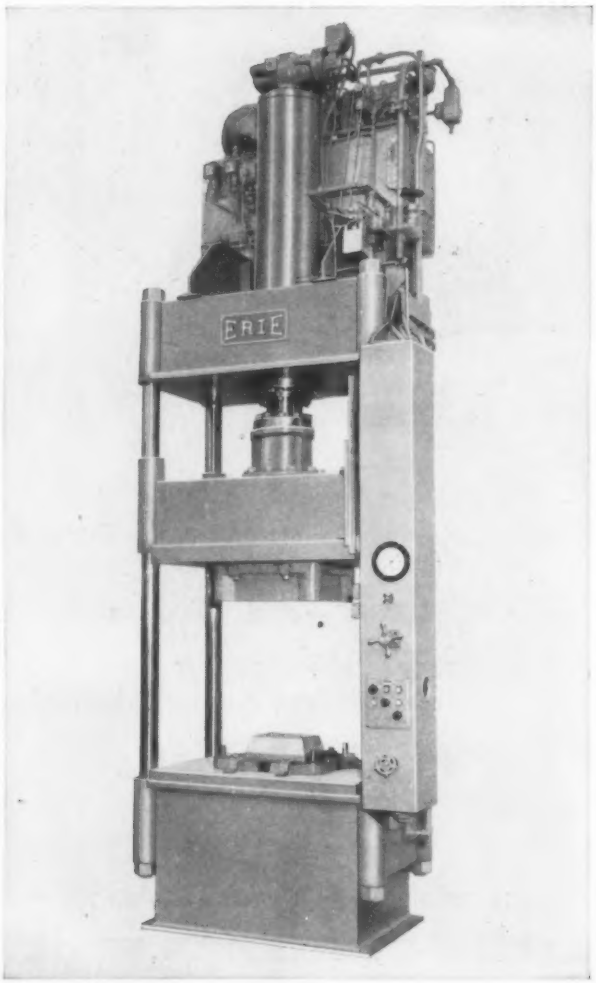
when the first physical properties tests were

used on vulcanized rubber . . . when one of the big names in the rubber

industry was Goodrich-Tew & Company . . .

when the first bicycle tires were rubber hose fastened on rims . . .

ERIE FOUNDRY COMPANY WAS A GREAT NAME IN COMPRESSION PRESSES



in today's plastic shop

. . . when fiberglass presses are supplied with either top or bottom rams

. . . when exacting requirements of fiberglass molding require adjustable speeds and tonnages . . .

. . . when regulated stripping strokes ease removal of molded parts . . .

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is the greatest name in specialized compression presses

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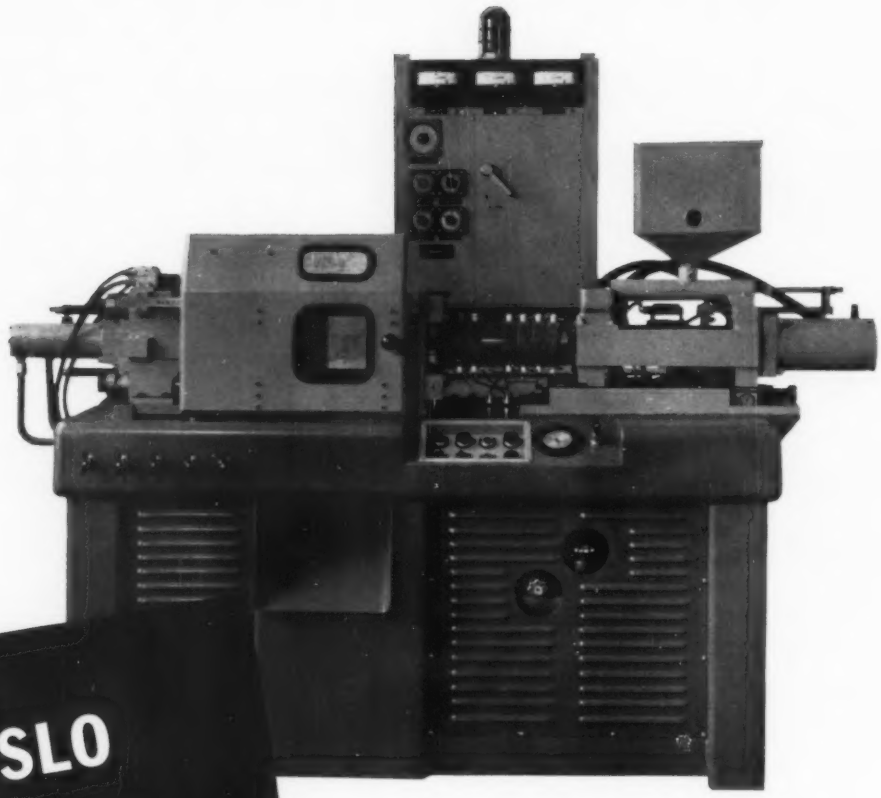


MOSLO

presents a new SUPER 2-OUNCE PLASTIC MOLDING MACHINE

Moslo stays in front with a hydraulic plastic molding machine *that has everything.* Known as the 74, it is similar in design, but twice the weight and strength of the former Model 73. This new model is the *fastest* and *heaviest* small machine on the market. Designed to handle the tough jobs, the Model 74 is a really super deluxe, 2 ounce machine.

Check these outstanding features and see why the Moslo 74 is your best bet.

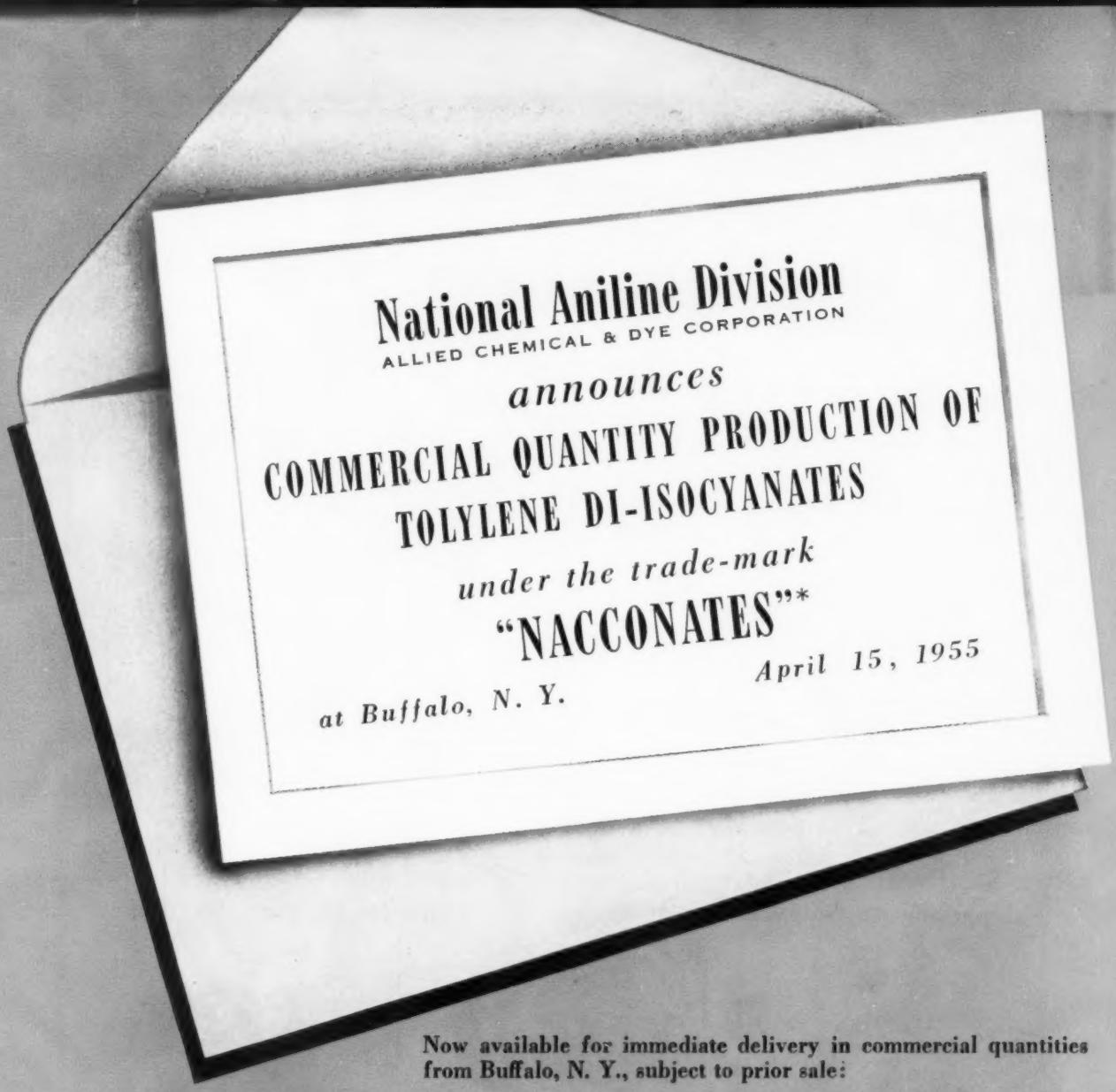
1. AUTOMATIC LUBRICATION of entire clamp mechanism.
2. HYDRAULIC INJECTION BOOSTER arrangement supplies full pressure for entire injection stroke.
3. HIGH SPEED PRODUCTION—plasticizing capacity of 50 pounds per hour.
4. FAST OPERATION—1250 cycles per hour (dry run).
5. HEAVY DUTY—Welded steel base and heavy gauge materials provide for sturdy and rugged construction.
6. HYDRAULIC MANIFOLD eliminates 60% of fittings and simplifies maintenance.
7. AUTOMATIC CONTROLS and SAFETY DEVICES assure maximum protection to operator, material, and machine.
8. MOLD SIZE—9″ x 12″.
9. MOLD CLAMP—75 tons.
10. PLUS FEATURES—incorporated in every Moslo machine are many exclusive features that have been developed from years of experience in the molding machinery business.

In addition to Model 74, Moslo also has available a sturdier Model 73 2 ounce machine. This model is a standard version of the Model 74 with fewer deluxe features and smaller plasticizing capacity.

Investigate Moslo before you buy any plastic molding machine.
We invite your inquiry and will be glad to send you additional information.

MOSLO MACHINERY COMPANY

2443 PROSPECT AVENUE • CLEVELAND 15, OHIO



Now available for immediate delivery in commercial quantities from Buffalo, N. Y., subject to prior sale:

National NACCONATE 80 Isomeric mixture of 80% 2, 4-tolylene di-isocyanate and 20% 2, 6-tolylene di-isocyanate

Also available for commercial development work:

National NACCONATE 65 Isomeric mixture of 65% 2, 4-tolylene di-isocyanate and 35% 2, 6-tolylene di-isocyanate

National NACCONATE 100 2, 4-tolylene di-isocyanate

National NACCONATE 200 3, 3′ bitolylene 4, 4′-di-isocyanate

National NACCONATE 300 Diphenylmethane 4, 4′-di-isocyanate

We invite inquiries for samples, technical data and quotations.

Watch the editorial and advertising pages of this publication for additional information on National NACCONATES

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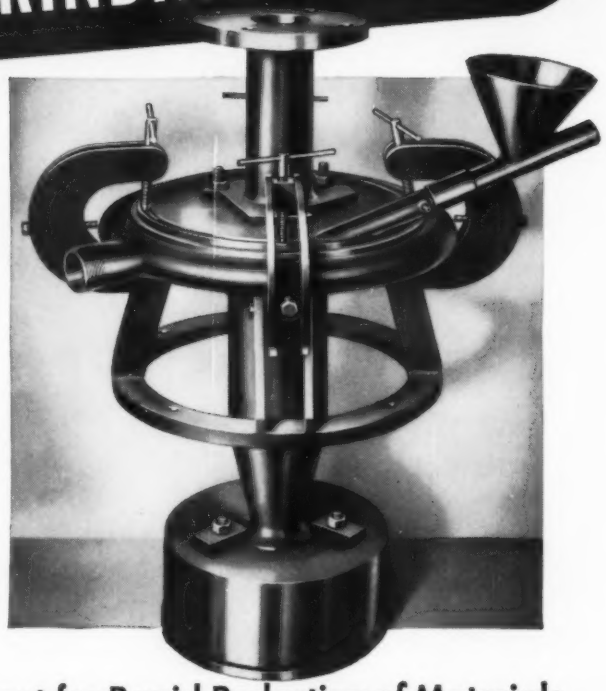
Sturtevant

MICRONIZER* GRINDING MACHINE



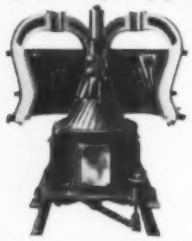
Reduces Solids to Micron Sizes

The new Sturtevant *Micronizer* grinding machine is a fluid jet grinder especially designed to reduce solid materials to particle sizes in the micron ranges.

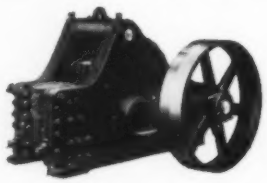
Sturtevant *Micronizers* are used for simultaneous dry grinding and classification of solids. The variety of materials that can be processed is large and includes both metallic and non-metallic minerals and ores, metals, pigments, insecticides, fungicides, pharmaceuticals, plastics, dyes and numerous other organic and inorganic products. Available in capacities from ½ to 3000 pounds per hour.

Other Sturtevant Pulverizing Equipment for Rapid Reduction of Materials...

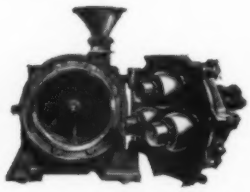
Especially Applicable for Initial Grinding of Products for the Micronizer Mill



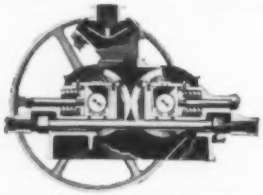
ROTARY FINE CRUSHERS for intermediate and fine reduction (down to ¼"). Open door accessibility. Soft or moderately hard materials. Efficient granulators. Excellent preliminary Crushers preceding Pulverizers.



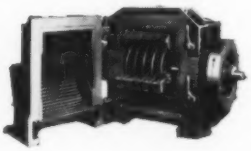
JAW CRUSHERS for coarse, intermediate and fine reduction of hard or soft substances. Heavy or light duty. Cam and Roller action. Special crushers for Ferro-alloys. Several types, many sizes.



RING-ROLL MILLS for medium and fine reduction (10 to 200 mesh), hard or soft materials. Very durable, small power. Operated in closed circuit with Screen or Air Separator. Open door accessibility. Many sizes. No scrapers, plows, pushers, or shields.



CRUSHING ROLLS for granulation, coarse or fine, hard or soft materials. Automatic adjustments. Crushing shocks balanced. For dry or wet reduction. Sizes 8 x 5 to 38 x 20. The standard for abrasives.



SWING-SLEDGE MILLS for coarse and medium reduction (down to 20 mesh). Open door accessibility. Soft, moderately hard, tough or fibrous substances. Built in several types and many sizes.

AIR SEPARATOR for separation of fines to 325 mesh and finer. Increases output from 25% to 300% . . . lowers power costs by 50%. Capacities ¼ to 50 tons per hour output.

*Registered trademark of the Sturtevant Mill Company

STURTEVANT MILL COMPANY

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DESIGNERS & MANUFACTURERS OF DENS AND EXCAVATORS • MIXERS • SCREENS • PULVERIZERS • ELEVATORS • AND COMPLETE FERTILIZER UNITS

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Why not investigate this modern approach to your money problems and learn how you can put your business on an all-cash basis, with wider opportunities for sales and profits.

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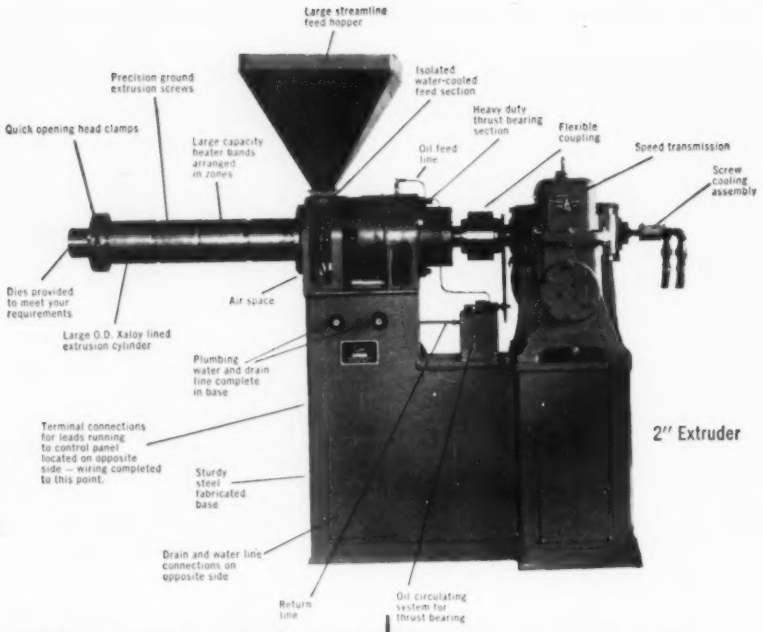
55 Madison Avenue, New York 10, N. Y.

Egan plastic extruder



2" Extruder

compare with the covers off!

Yes, when you remove the covers and get down to the bare facts of construction of this unique extruder, you will find a machine which will have longer effective screw lengths, greater maximum heating capacity, and larger thrust bearing capacity. This will add up to higher production rates, better products, and lower maintenance and operating costs. With the flexible design of the "extrusion" unit consisting of the separate components; screw, heating cylinder, feed section; and thrust bearing housing, we can give you any combination to meet your requirements.

EGAN EXTRUDERS are supplied complete with a *wired* control panel including the main disconnect switch, fuse blocks, contacts and temperature controls *mounted*. Plumbing for the water supply and return lines to the drain are completed in the base. Installation costs are held to a minimum.

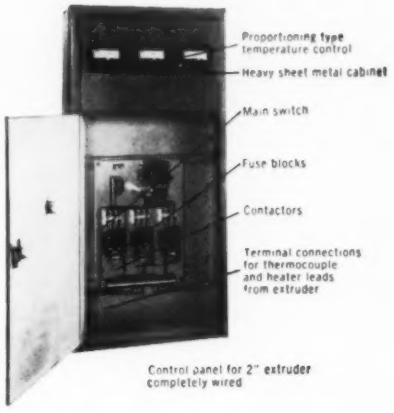
EGAN EXTRUDERS can be furnished with dies, conveyors, take-off equipment and other auxiliary features for a wide range of extruded products.

Write for details or invite our representative to call

FRANK W. EGAN & COMPANY, Somerville, New Jersey

Designers and Builders of Machinery for the Paper Converting and Plastics Industries

Cable Address: EGANCO—SOMERVILLE (NJER)



Control panel for 2" extruder completely wired

Compare specifications of any standard Egan Extruder, size for size, with any other extruder.

Standard Sizes (Screw Dia.)—inches	2	2½	3½	4½	6	8
Effective Screw Length—inches	32	40	56	72	96	128
No. Cylinder Sections	1	1	1	1	2	2
Zones of Heating on Cylinder	2	2	3	4	4	4
Maximum Heating Load, KW	12	18	30	48	96	160
Thrust Bearing Capacity, 1000 lbs. @ 50 rpm.	60.5	60.5	119.5	208	288	420
Type Speed Transmission	Worm gear.	Worm gear.	Herr' bone	Herr' bone	Herr' bone	Herr' bone
Usual Motor Size, H. P.	7½-10	10-15	20-30	40-50	50-75	75-150
Approx. Extrusion Capacity lb./hr.	20-50	40-90	75-200	150-450	250-650	450-1200
Approx. Floor Dimensions—inches	40x98	48x112	60x120	84x132	96x156	104x192
Approx. Weight—lbs. (less Drive)	3200	3600	4800	6600	9600	12500

**Extruders are modified to meet requirements for a particular process*

From sturdy fishing rods to handy soup kitchens!

Pittsburgh Selectron

POLYESTER RESINS

Now Ready For A Thousand New Uses

PITTSBURGH SELECTRON Resins have opened new opportunities for much greater product usefulness with reduced manufacturing costs.

When combined with suitable fillers these remarkable resins have been used to mold products that are lighter than aluminum with strength-weight ratios and impact resistance surpassing those of any other known materials. They also provide unusual resistance to weather, sunlight, heat, abrasion and many chemicals.

That's why SELECTRON Resins are today being used in a wide range of products. These can be as different in size, shape and weight as the new "glass" fishing rods so popular among anglers and the modern displays used in Heinz Fast-Food Kitchens. These displays were designed by the Milwaukee Industrial Designers, of Milwaukee, Wisconsin, and molded by G. B. Lewis, of Watertown, Wisconsin.

SELECTRON Resins are of the thermo-setting type. They polymerize to form solids with or without heat and with or without pressure. Parts in which they are used can be molded either by hand lay-up, direct molding, continuous lamination or pre-forming. These resins can also be used without fibers for casting, potting and impregnating.

We'll be glad to have one of our engineers discuss your problems with you without cost or obligation. This may save you time and money.

Send For FREE Booklet!

Write, wire or phone today for our new booklet containing descriptions of SELECTRON Resins and explaining many of the ways in which they can be used. Pittsburgh Plate Glass Company, Selectron Products Division, Gateway Center, Pittsburgh, Pa.

Just a few products in which Pittsburgh SELECTRON Resins are now used—

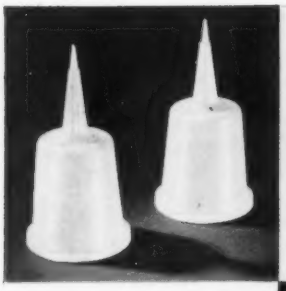
Aircraft structural parts
Radomes for electronic equipment
Life floats
Ballistic panels
Helmets
Boat hulls
Machinery housing and guards
Trays
Tote boxes
Food lockers
Garbage pails
Baskets for automatic dishwashers
Baskets for automatic washers
Wash tubs
Tool chests
Shipping containers
Instrument cases
Laundry hampers
Kitchen containers
Fishing rods
Sinks
Street signs
Traffic signs
Fluorescent light fixtures
Television cabinets
Loudspeaker housings
Gas meter housings
Structural panels for offices and homes
Door and transom lights
Awnings and canopies
Greenhouse panels
Skylighting
Molded chairs
Prefabricated houses and garages
Truck bodies

PITTSBURGH Selectron

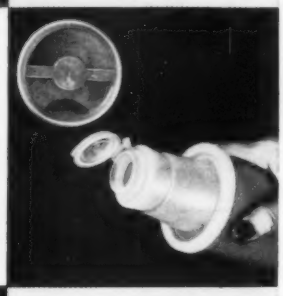
PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS • FIBER GLASS

PITTSBURGH PLATE GLASS COMPANY

IN CANADA: CANADIAN PITTSBURGH INDUSTRIES LIMITED



NOBODY HAS AS MUCH EXPERIENCE AT MOLDING POLYETHYLENE AS TUPPER!



Tupper Seals are air and liquid-tight flexible covers. The famous Pour All and Par Top covers are designed for easy dispensing. They are made in sizes to fit all Tupperware containers.

The logical molder for you to consult regarding that product or package of yours which is to be made of polyethylene is Tupper. Tupper has done more than any other molder to make molded polyethylene a practical reality.

Aside from having designed, patented, and promoted successful seals, closures, and dispensers for polyethylene containers, the Tupper Corporation has vast experience in *every phase* of polyethylene packaging and polyethylene injection molding. This experience will be of major importance in improving your product, in reducing your costs, when Tupper goes to work for you.

Tupper's combination of experience, technical ingenuity, and the most modern equipment is at your service for the custom molding of your product in polyethylene. You can do no better than the best ... and the best at molding polyethylene is Tupper!

When equipped with Tupper Seals, Tupper Canisters, Sauce Dishes, Wonder Bowls, Cereal Bowls and Funnels in various sizes are the most versatile reusable containers you have ever seen.

TUPPER!
TRADE MARK

TUPPER PRODUCTS ARE FULLY PROTECTED

About 150 United States and foreign patents and patents applied for, plus numerous trademarks and copyrights, cover the design and manufacture of the various types of Tupper Seals and other Tupper Products. Unauthorized manufacture of items covered by Tupper patents will subject infringers to prosecution.

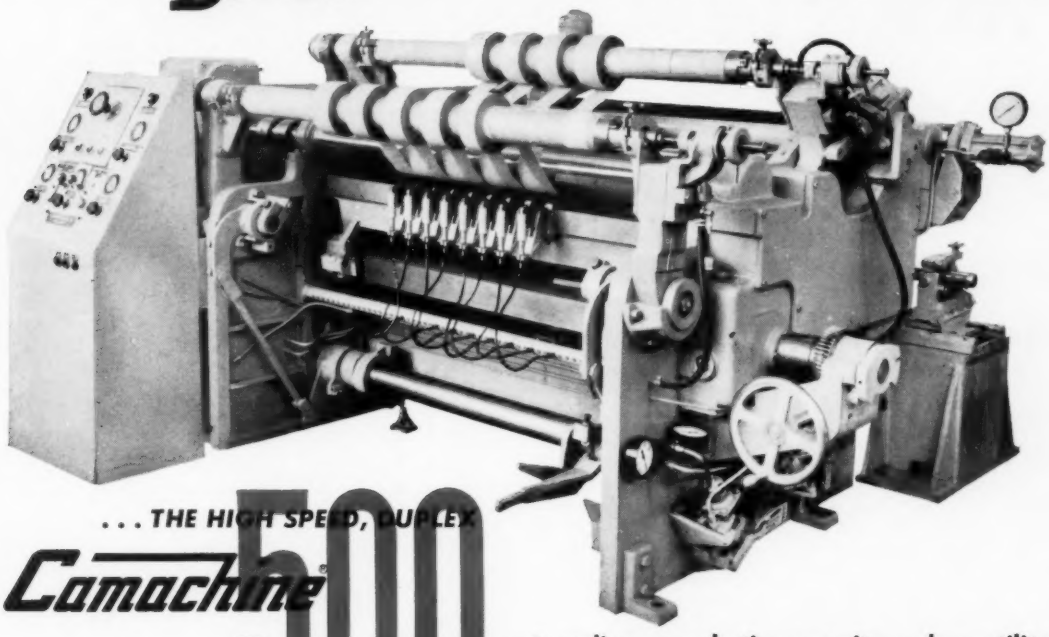
TUPPER CORPORATION

Manufacturers of — CONSUMER, INDUSTRIAL, PACKAGING AND SCIENTIFIC PRODUCTS

Factories, Laboratories and Sales Offices:
Farnumsville, Mass., Orlando, Fla., L'Epiphanie, P.Q.
Showrooms: 225 Fifth Ave., N. Y. C.

Address All Communications To: Dept. M-6

It's the BIG NEWS in modern roll production!



. . . THE HIGH SPEED, DUPLEX

Camachine® 500

extraordinary productive capacity and versatility for true economy plus winding and slitting quality

The new Camachine 500 gives you exactly what you want in roll density, internal tension, and quality of edge — meets the most exacting demands at unparalleled production rates. The new **500** provides, in one machine, the versatile ability to slit and wind light, heavy, stretchy or rigid plastics, laminates of all types, waxed or coated papers, kraft, foil, impregnated fabrics and other materials. Rolls produced on the **500** give you the softness or hardness you need for shipping, storage and subsequent end use—and each roll has exactly the type edge you require.

REWIND QUALITY: Here's why the 500 can offer, for the first time, completely controllable rewind roll quality to meet all specifications.

● Automatic rewind density control, adjustable while running ● Automatic variable speed rewind drive for minimum core heating and maximum drive stability when using differential winding, and for maximum stability and control when using "locked core" combination or center winding ● Precise, infinite variable rewind torque controls ● Rewind tension is positively isolated from unwind tension—web tension cannot build up between the unwind and rewind ● Ultra-sensitive, pneumatic unwind tension control, adjustable for all materials, eliminates stretching, snap-off and slack—assures smooth, full-control starts and stops for "middle-of-the-run" splicing or culling.

The newly developed side register control can be provided as an integral part of the winder. Its rate of response and its accuracy are unmatched, whether guiding to a printed line or to the edge of the web. In one plant it is used for high speed production of **saleable rolls without trimming!**

PRODUCTION FLEXIBILITY: Quick change-over from one slitting method to another provides unusual versatility.

The **500** is available with a variety of slitting methods including score-cut; shear-cut; razor-cut; burst-cut; or "Sealcut" for fusing. It can be equipped with any of these or with a combination of them. The versatile **500** provides, on one machine, a choice of the most desirable type of slitting for every job.

Consistently accurate precision controls and gauges virtually eliminate operator guesswork and "feel"—rolls of unvarying quality are assured. Recorded settings permit perfect reproduction of satisfactory runs of any material at any time. The precision, sensitivity and wide range of all controls provide optimum running conditions for an extraordinary variety of materials.

Camachine 500

Trim widths up to 72"; finished rolls to 20" diameter; speeds to 2000 fpm depending upon width of machine and character of products. Write for Bulletin 1050 today.

CAMERON MACHINE COMPANY • 61 Poplar Street • Brooklyn 1, N. Y.

Hotpoint SELECTS RICHARDSON

FOR THESE MOLDED PARTS . .

. . this molded plastic impeller, perfectly balanced for high speed rotation during washing, rinsing, and drying cycles, a vital part . .

. . of this Hotpoint Dishwasher

. . this molded plastic thermostat switch, an important part . . of this Hotpoint Range . . and of this Hotpoint automatic electric clothes dryer . .

Richardson know-how, based on thousands of jobs and years of experience in plastics, produced both the intricate Bakelite molded thermostat switch and the sturdy, streamlined impeller shown above. Richardson engineers, specialists in both molded and laminated plastics, will welcome the opportunity to discuss your requirements.

Send your specifications or blueprints . . find out how Richardson facilities and services can assist you. No obligation, of course.

RICHARDSON PLASTICS
LAMINATED AND MOLDED

MELROSE PARK, ILL. | INDIANAPOLIS, IND. | NEW BRUNSWICK, N. J. | NEWNAN, GA. | OGDEN, UTAH | TYLER, TEXAS

The RICHARDSON COMPANY
FOUNDED 1858
2789 Lake St., Melrose Park, Ill. (Chicago District)
SALES OFFICES IN PRINCIPAL CITIES

ELECTRIFY

your sales and production

with

CYCOLAC®

THE *New* HIGH-IMPACT THERMOPLASTIC RESIN

CYCOLAC has the very basic material properties needed in many electrical end-uses: Rugged toughness plus lightweight . . . low water absorption . . . high demolding (sag) temperature plus low brittle point . . . excellent electrical properties combined with greater dimensional stability. List at right is a small example of the many, many practical uses of CYCOLAC in your manufacturing.

THE PERFECT RESIN FOR THE MANUFACTURE OF ELECTRICAL PRODUCTS SUCH AS THESE —

COIL FORMS
CABLE AND WIRE CONNECTORS
INSULATOR BUSHINGS
SWITCH PARTS
INSTRUMENT COVERS
TERMINAL BOXES
BRUSH SET-SCREWS
RE-SET BUTTONS
THERMOSTAT COVERS

PLUS a thousand-and-one other uses

CYCOLAC — the one uniform resin that makes good products BETTER

Marbon®

MARBON CHEMICAL

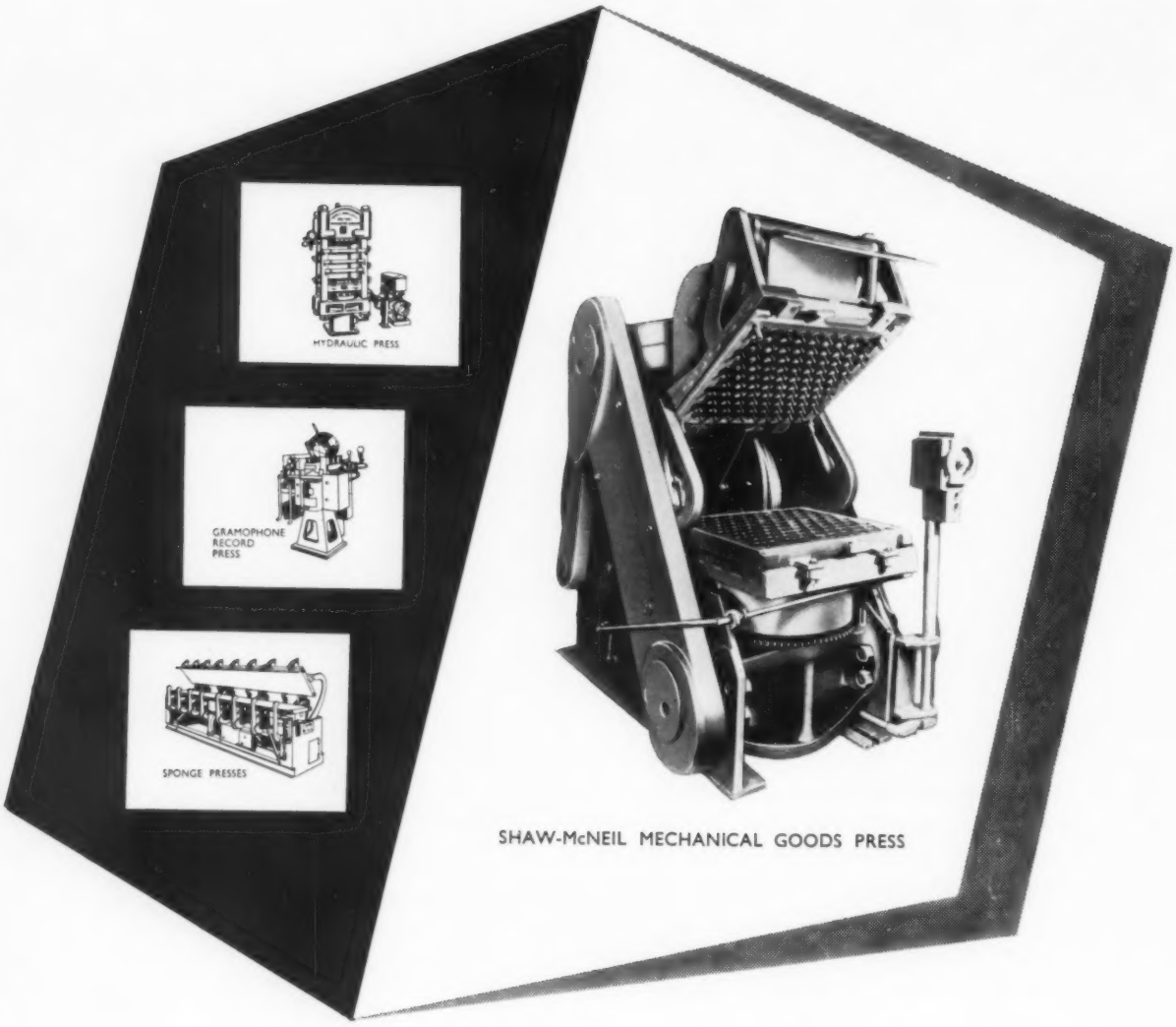
Division of BORG-WARNER CORPORATION

GARY, INDIANA

MARBON . . . Precision Resins for Precision Made Products

high output with uniformity

automatically assured



Uniformity is the key to production. The Shaw range of hydraulic and mechanical presses ensure this uniformity on a multifarious range of products. The SHAW-McNEIL Mechanical Goods Press featured is only one of an outstanding range of machinery. Motor operated—no hydraulics—it maintains 780 lbs. p.s.i. platen pressure, and allows for simple, quick adjustment of the lower platen adjustments for mould loadings of zero to 400 tons.

SHAW presses for rubber and plastics

FRANCIS SHAW & COMPANY LIMITED, MANCHESTER II, ENGLAND

LONDON OFFICE: 34, Victoria Street, London, S.W.1. Telephone Abbey 5077/8

Enquiries to:

FRANCIS SHAW (CANADA) LIMITED GRAHAM'S LANE BURLINGTON ONTARIO CANADA

TELEPHONE: NELSON 4-2250 *TELEGRAMS:* CALENDER BURLINGTON ONTARIO

Glass reinforced polyester chair manufactured by the Selig Chair Company. Shell is molded by the Prolon Plastics Division of Pro-phy-lac-tic Company.

Why this chair is made with PARAPLEX P-47

The shell of this smartly-designed modern chair is molded of glass fibers and PARAPLEX P-47 polyester resin. Chair manufacturer and customers alike are pleased with the strength, durability, and beauty which PARAPLEX P-47 provides. The molder of the shell is impressed with the resin's working advantages.

PARAPLEX P-47, when cured, is rigid and tough, yet flexible enough so that squealing does not occur upon flexure. The resin releases readily from hot molds, has high strength and rigidity at elevated temperatures, and has good resistance to cracking and crazing—even in resin-rich areas. Other advantages are fast curing speed and low specific gravity, both of which can mean appreciable cost savings.

For more information on PARAPLEX P-47, and other PARAPLEX resins as well, write Department WW-155.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

Representatives in principal foreign countries

PARAPLEX *is a trade-mark, Reg. U.S. Pat. Off. and in principal foreign countries.*

UNITIZED PUMP . . .
all pumping equipment in one compact assembly

CUSTOM BUILT AT LOWEST PRICE . . .
job engineered from standard components

LEAK-FREE CONSTRUCTION . . .
of special welded fittings and seamless tubing

TAKE A BIG LOOK

at Columbia Hydraulic Compression Moulding Presses

PRECISION CONSTRUCTION . . .
for more production, fewer rejects

Every Columbia Hydraulic Compression Moulding Press feature assures easy operation, high output, quality production and minimum maintenance. These characteristics are important to profitable production of compression moulded parts.

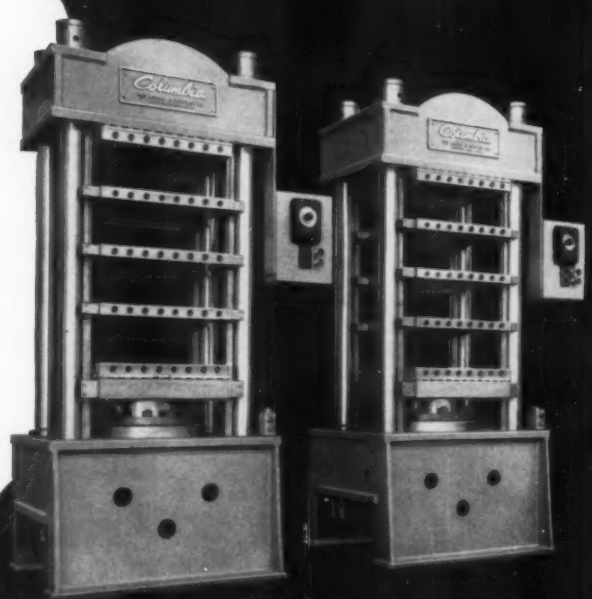
Consider the construction of the base and crown. Ruggedly made of heavy steel plate, the design of these parts absolutely minimizes deflection. Alloy steel strain rods have heavy, fine-thread nuts with special locking devices. The pressure platen is guided by the cylinder and by all four strain rods.

For higher production and quality, lower cost and maintenance . . . take a **BIG** look at Columbia features!

Write for FREE Bulletin HP-8 and the name of your nearest distributor

THE **Lodge & Shipley** COMPANY

HAMILTON DIVISION • Hamilton 12, Ohio



COMPRESSION MOULDING PRESS • 250 TON PRESS
Platen Size 24" x 24" with 4 daylights

NOW! Colorful Plastainer Vials BY OWENS-ILLINOIS

Plastainer vials are now available in a wide variety of attractive colors, opaque and transparent, with colorful matching closures. They are typical examples of the many sizes, shapes and colors of containers the broad plastic molding facilities of Owens-Illinois make possible to fill your needs.

You can package anything from candy beads to fishing tackle in Plastainer vials by Owens-Illinois. They protect contents from handling, air and moisture until used. Plastainer vials won't split or crack . . . have wide diameter for easy filling and stable base . . . come in 6 sizes: 3 to 15 drams.

Owens-Illinois packaging know-how and high-quality standards offer you the finest in plastic molding facilities . . . Injection molding . . . Compression molding . . . A complete range in plastics for packaging, for specialties.

Branch Offices:

Albany . . . New York	Columbus . . . Ohio	Memphis . . . Tennessee	Portland . . . Oregon
Atlanta . . . Georgia	Dallas . . . Texas	Milwaukee . . . Wisconsin	Richmond . . . Virginia
Baltimore . . . Maryland	Denver . . . Colorado	Nashville . . . Tennessee	Rochester . . . New York
Birmingham . . . Alabama	Detroit . . . Michigan	New Orleans . . . Louisiana	St. Louis . . . Missouri
Boston . . . Massachusetts	Fresno . . . California	New York . . . New York	St. Paul . . . Minnesota
Buffalo . . . New York	Houston . . . Texas	Oakland . . . California	Salt Lake City . . . Utah
Charleston . . . West Virginia	Indianapolis . . . Indiana	Oklahoma City . . . Oklahoma	San Francisco . . . California
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OWENS-ILLINOIS PLASTICS
AN (I) PRODUCT

OWENS-ILLINOIS
GENERAL OFFICES • TOLEDO 1, OHIO

The quick, easy way to mold reinforced plastics

DAKE PLASTICS PRESSES

Speed output, reduce cost

- Engineered by men experienced in reinforced plastics
- Used for either experimental or production work
- Fully described in Bulletin #273

Molding safety helmets on a Dake Plastics Press — Model 18-187, 25-ton capacity. Production rate is expected to reach 45 to 50 per hour. Welding helmets are also molded on this press.

Close-up of the helmet before flash is removed. Helmets weigh only 12 oz — withstand much more than the 40 ft-lb required.

FEATURES

GUIDED PLATEN for accurate alignment

CONTROL can be automatic, semiautomatic, or manual

FAST RAM APPROACH speeds closing of movable platen, which slows automatically as work is approached

PRESSURE ADJUSTABLE from half to full press capacity

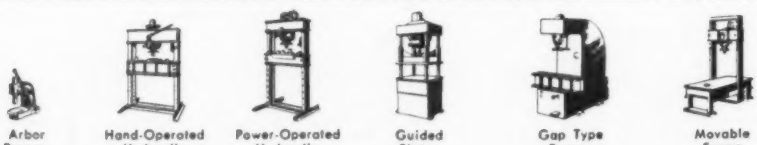
ELECTRIC TIMER holds pressure during curing cycle—adjustable from 12 sec to 6⅔ min—after which ram returns automatically

CAPACITIES from 25 to 300 tons

HEATED PLATENS can be provided

Dake Corporation, 648 Seventh St., Grand Haven, Mich.

DAKE PRESSES



Arbor Presses · Hand-Operated Hydraulic · Power-Operated Hydraulic · Guided Platen · Gap Type Presses · Movable Frame

Skill... makes the difference

In applying wood-grains, textile patterns, leather, mother-of-pearl and other intricate designs on metal, wood, composition board or plastics, SKILL makes the difference between a shoddy imitation and a fine reproduction that can confidently take its place alongside the original.

Not one, but many skills are represented in an

IC *Polyfax** REPRODUCTION

. . . SKILL in making the engravings which must be accurate in every minute detail to bring out the natural highlights and delicate shading of tones.

. . . SKILL in matching the ground-coats and inks which work together to reproduce the glorious colors of natural mahogany or the delicate pastels of English harewood.

. . . SKILL in building into the ground-coats the durability factors which assure your product long years of satisfactory performance.

. . . SKILL in building into the inks the working qualities that permit sharp, high-fidelity prints hour after hour, day after day.

Only in IC POLYFAX can you buy ALL of these skills in ONE place.

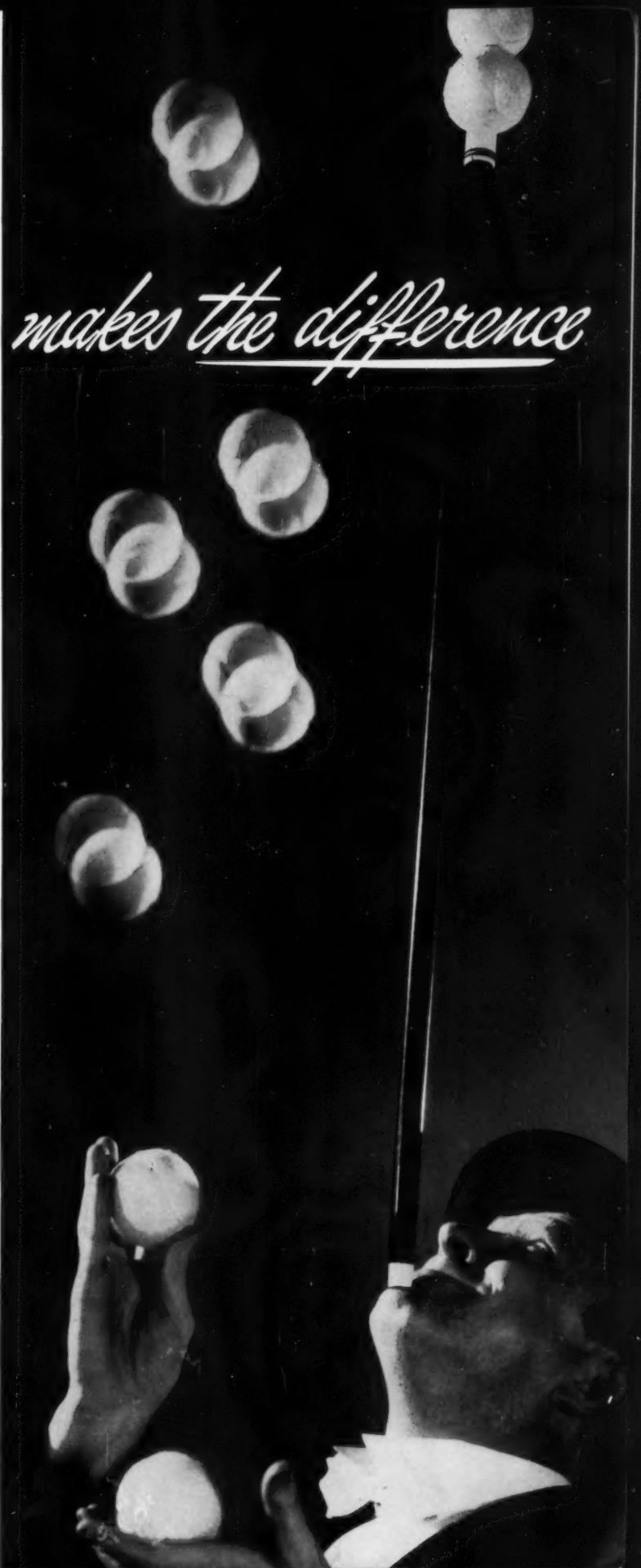
Send for your copy of the new bulletin, "POLYFAX—THE KEY TO DISTINCTIVE STYLING."

*Polyfax is a registered trade-mark of Interchemical Corporation for coating compositions for reproductions of wood, fabric, marble, leather and other analogous finishes, and for the services connected with the use of such compositions.

Interchemical
CORPORATION
Finishes Division

FACTORIES: CHICAGO, ILL. • CINCINNATI, OHIO • ELIZABETH, N. J.
LOS ANGELES, CALIF. • NEWARK, N. J. • MEXICO CITY, MEXICO

In Canada, IC products are sold by AULCRAFT PAINTS LTD., Toronto, Ont., under its trademarks.



Fiore electroformed metal masks and spraying equipment

Precision-fit Fiore masks often spell the difference between a low cost, first rate paint job and sloppy decorating that costs far more than it ought to. Fiore masks assure sharply defined edges and close registration of colors. They are *engineered* by *specialists* who have designed and built all types of masks for some of the country's leading, most particular molders.

SPRAYING EQUIPMENT—Quality in spray painting plastics depends on having jigs, fixtures, spray guns and booths which allow you to use your masks with maximum efficiency and speed. Fiore spray equipment is engineered to the same high quality as Fiore masks.

Write today for additional details. Include samples or drawings for estimates on electroformed masks that will insure precision spraying.

Typical products decorated with Fiore electroformed masks and spraying equipment.

WM. M. FIORE INC.

135 Liberty Street New York 6, New York

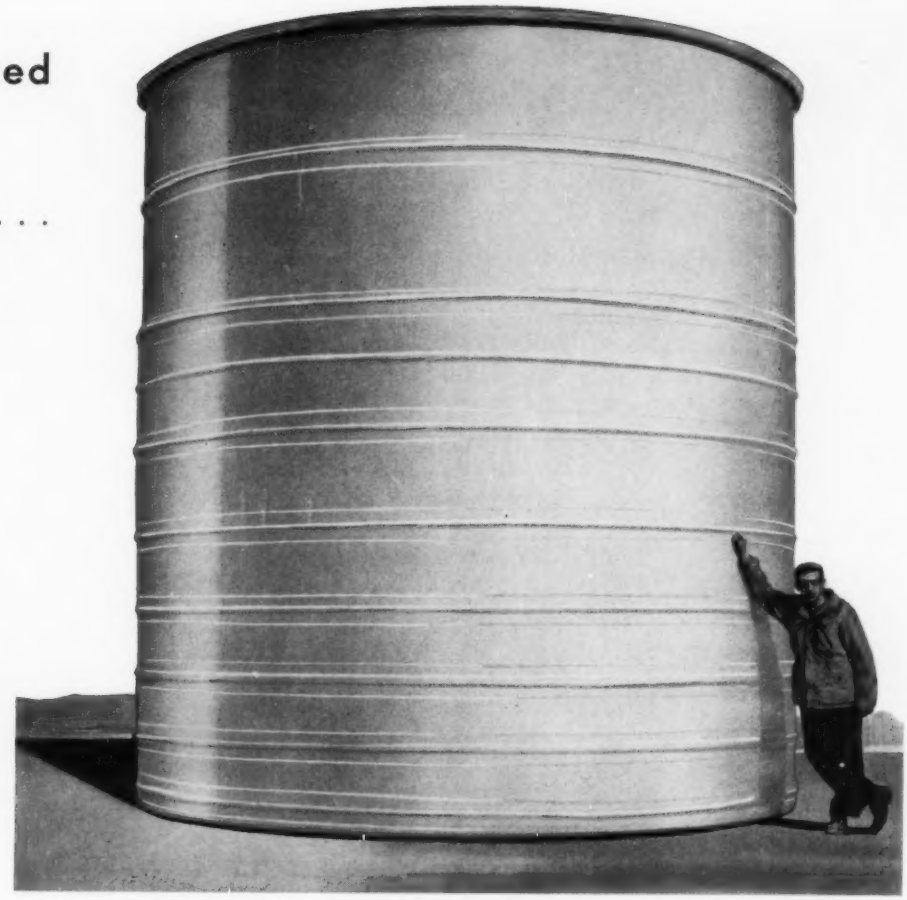
BArclay 7-2569

for man-sized
problems
and larger . . .

Bigelow

has the
solution!

BIGELOW
Fiber Glass
Products



20,000 gallon tank for waste chemicals fabricated by the Carl N. Beetle Plastics Corp., Fall River, Mass.

BIGELOW FIBER GLASS PRODUCTS CAN SOLVE YOUR PROBLEMS NO MATTER HOW COMPLEX!

Problem solution through superior reinforcing materials is indeed Bigelow's most important product! This engineering service plus a complete line of glass reinforcing materials—glass mats, woven roving, and glass cloth puts Bigelow Fiber Glass Products way out in front! For further information, fill out this coupon:

Bigelow had a tall order—furnishing a *reinforcement* strong and uniform enough to be used in fabricating a large tank—*and at the lowest possible cost!* The Carl N. Beetle Plastics Corp. selected Bigelow for their record of accomplishment in the fiber glass field.

A unique fiber glass product was engineered—ROVCLOTH 6060-0505 (Bigelow's trademarked woven roving) . . . 25.5 oz. weight, breaking strength in excess of 900 lbs. in warp and fill, with an .050" thickness, and 108" in width. This resulted in an end product that met all specifications for corrosion-resistance!

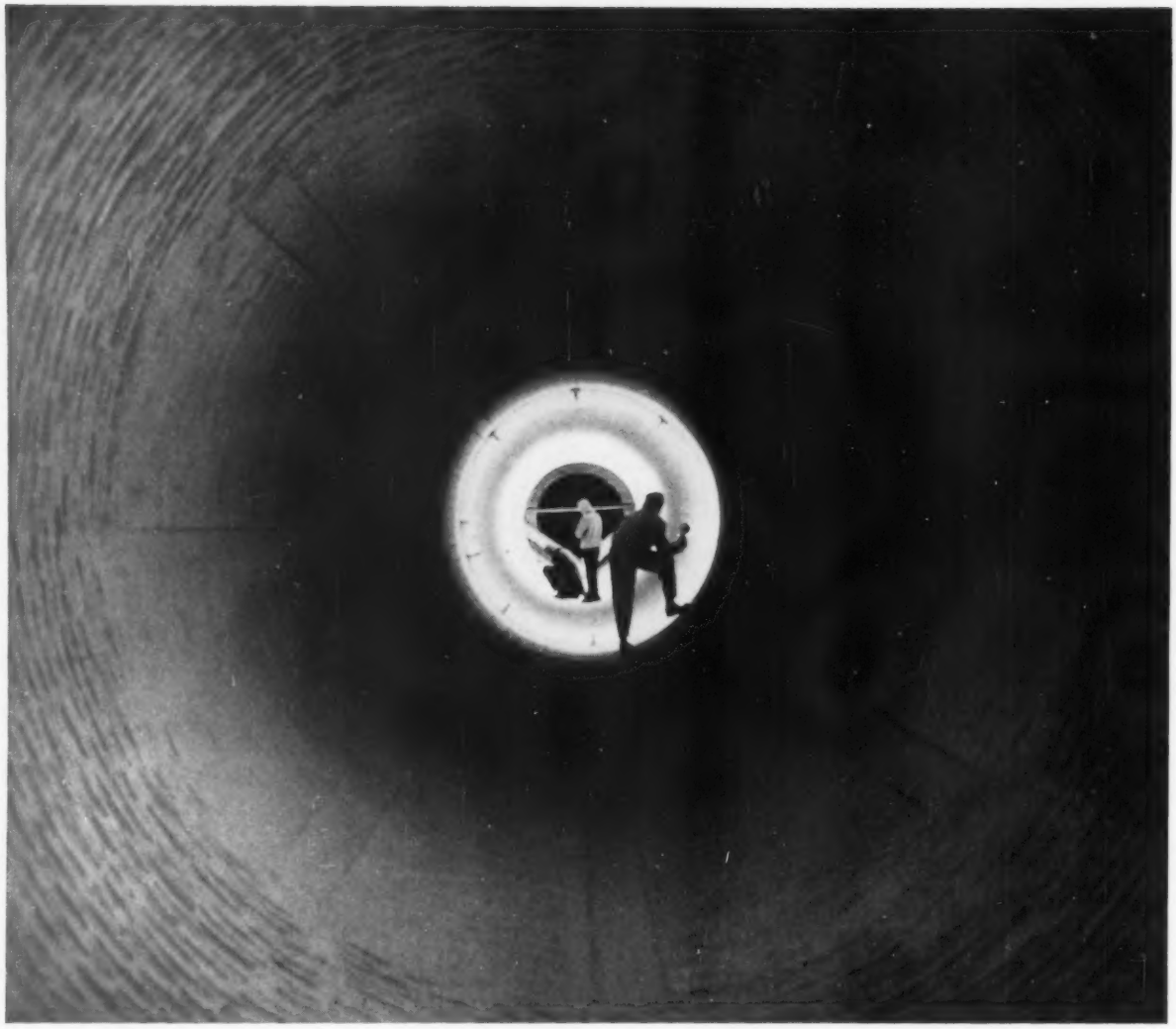
Bigelow Fiber Glass Products
Division of
BIGELOW-SANFORD CARPET COMPANY, INC.
140 Madison Avenue, New York 16, New York

MIDWEST OFFICE:
243 West Congress St., Detroit 26, Michigan

BIGELOW FIBER GLASS PRODUCTS
140 Madison Avenue, New York 16, N. Y.

Please send complete information on Bigelow Fiber Glass Products.
☐ Glass Mats ☐ Woven Roving ☐ Glass Cloth

NAME .....
FIRM .....
ADDRESS .....
CITY ..... STATE .....



bull's-eye for quality

This huge calciner represents just one step in the TITANOX quality story. In this mammoth rotary kiln, titanium hydrate is converted to titanium dioxide. Here are developed, through careful heat treatment, the unique optical properties of TITANOX pigments—unsurpassed whitening, brightening and opacifying power.

Subsequent operations add to these optical properties such desirable qualities as ease of dispersion and freedom from coarse particles.

From the full lines of "pure" and composite TITANOX white pigments, you can select one or a combination to fit any of your pigmentation needs. Your TITANOX representative and our Technical Service Department are always ready to help you make the right choice. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; Atlanta 2; Boston 6; Chicago 3; Cleveland 15; Los Angeles 22; Philadelphia 3; Pittsburgh 12; Portland 9, Ore.; San Francisco 7. In Canada: Canadian Titanium Pigments Limited, Montreal 2; Toronto 1.

® TITANOX

the brightest name in pigments

2816-A

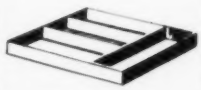
TITANIUM PIGMENT CORPORATION

Subsidiary of NATIONAL LEAD COMPANY

On ALL Jobs . . . At LOW Production Cost . . .


CORRUGATED
GLASS MAT


AIR- CRAFT
RADOMES


TRAYS AND TOTE BOXES


TANKS


LUGGAGE


DECORATIVE LAMINATES


WASHER TUBS


CHAIRS


ELECTRICAL INSULATORS

ELMES REINFORCED PLASTICS MOLDING PRESSES

"Deliver the Goods!"

You can depend upon Elmes® Reinforced Plastics Molding Presses to meet your needs *exactly* and at *lowest* production cost. They're "built that way". . . *Elmes-engineered* to fit the job . . . simple and easy to use . . . fast, flexible, and economical to operate.

Following are a few of the outstanding construction and operating features of these presses, specifically designed for the molding of reinforced plastics:

- **Presses are self-contained units,** ready for operation when supplied with hydraulic fluid and connected to your power source. Installation costs are low.
- **Semi-automatic operation.** Press is equipped with push-button controls, including adjustable timer which automatically regulates length of cure cycle.
- **50% pullback capacity** provides ample stripping tonnage for all sizes and types of moldings.
- **Pressing and stripping speeds,** regulated by floor-level controls, are **fully and independently adjustable.** Operator can adjust speeds from maximum to approximately 0″ per minute.
- **Daylight opening adjustment** is made by changing a spacer between ram and platen—much simpler than making threaded column adjustments.
- **Extra-long platen guides** assure accuracy of finished part by maintaining parallelism of platen and base.

Complete details on these and other Elmes Hydraulic Presses for plastics molding will be gladly supplied on request. See your authorized Elmes Distributor, or write to us direct.

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CHEMICAL PROGRESS WEEK-MAY 16-21

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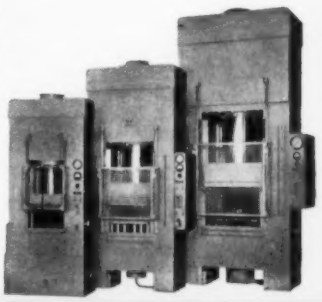

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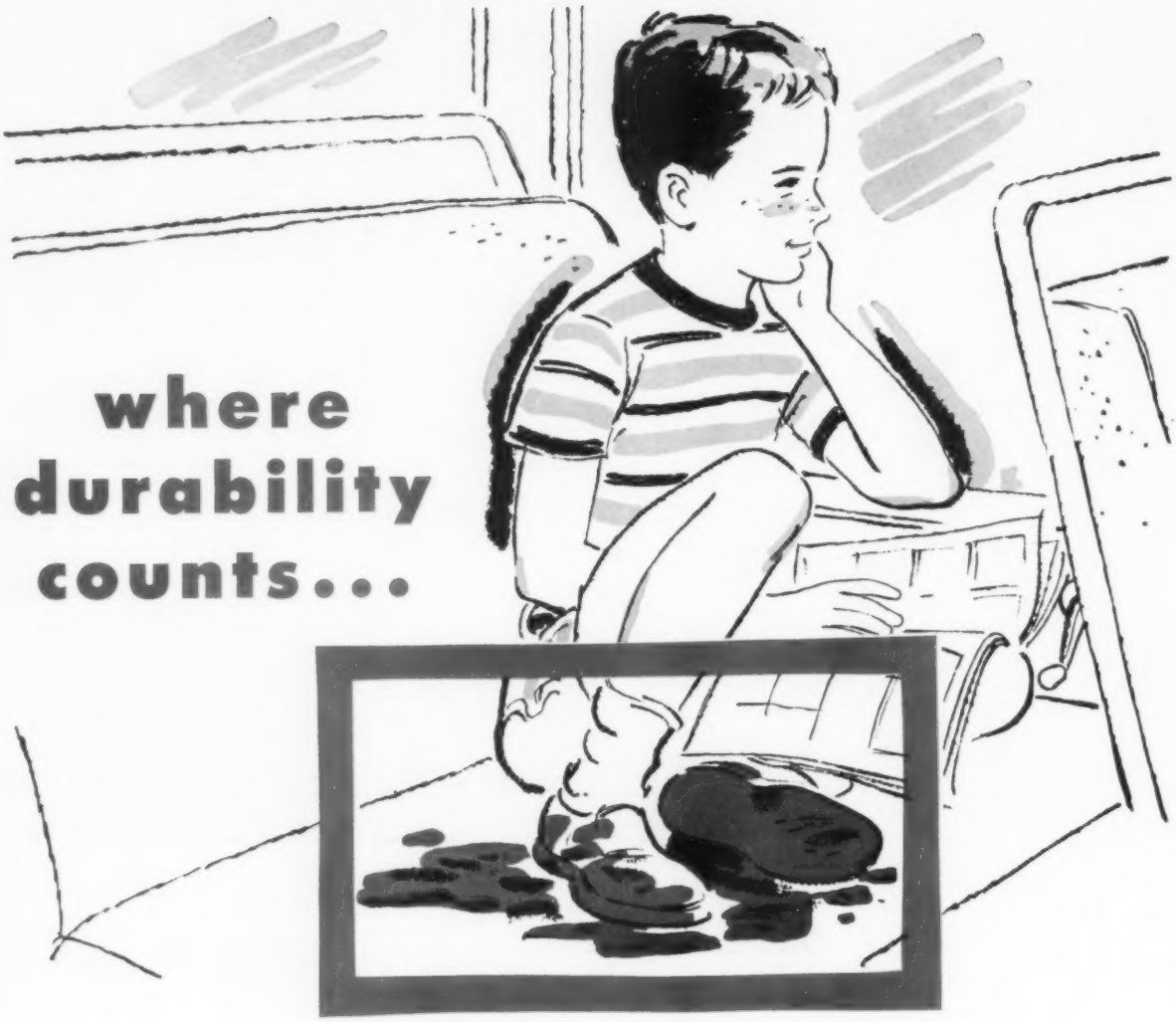

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MODERN PLASTICS
VOLUME 32 NUMBER 10 JUNE 1955

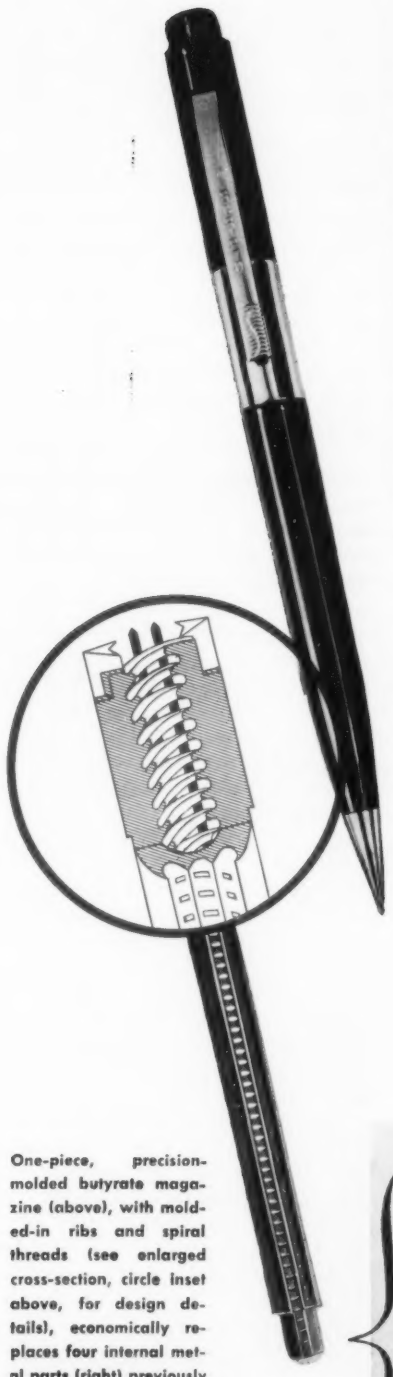
Plastics Write New Chapter for

FOUNTAIN PENS
BALL POINT PENS
MECHANICAL PENCILS

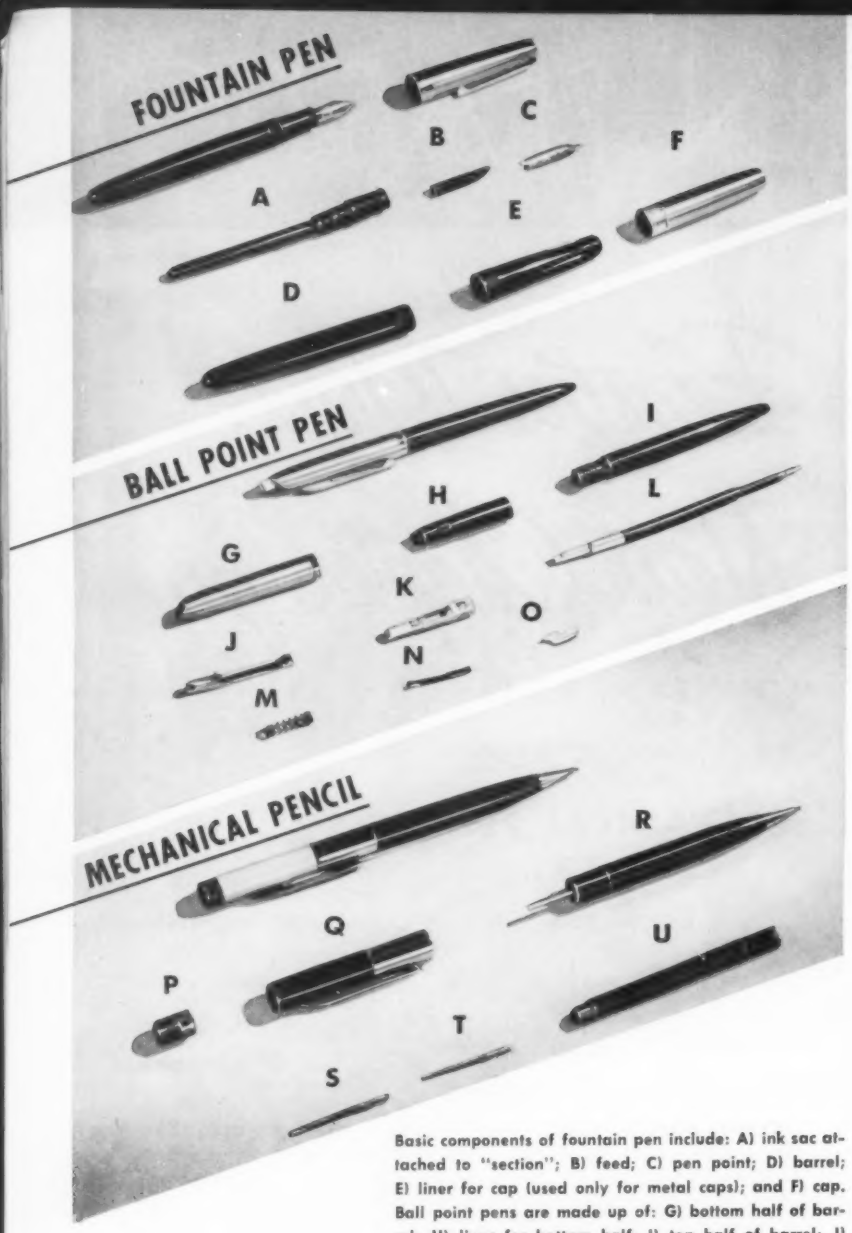
Many innovations in design, construction, and manufacture of many writing instruments depend for success on the versatility of many plastics materials

IN THE atmosphere of intense competition which pervades the pen and pencil industry, producers—perhaps because of their long-time use of old-line plastics—are probably more sensitive to plastics materials development than any other manufacturing group in America today. Every manufacturer is constantly searching for improvements that will give his product a selling edge over that of his rivals—and the design potential of plastics, their color possibilities, their lustrous surface finishes, their ease of fabrication, their pleasant feel, and their dimensional stability provide him with the tools with which he can best work.

This holds true not only for the smartly designed barrels and caps of pens and pencils, which are an accepted market for (*To page* 89)



One-piece, precision-molded butyrate magazine (above), with molded-in ribs and spiral threads (see enlarged cross-section, circle inset above, for design details), economically replaces four internal metal parts (right) previously used in one of Scripto's mechanical pencils



Basic components of fountain pen include: A) ink sac attached to "section"; B) feed; C) pen point; D) barrel; E) liner for cap (used only for metal caps); and F) cap. Ball point pens are made up of: G) bottom half of barrel; H) liner for bottom half; I) top half of barrel; J) clip; K) housing for spring assembly that retracts ball point tip; L) ink cartridge; M) and N) spring assembly; and O) push button for releasing spring. Mechanical pencil parts include: P) end cap; Q) bottom half of barrel; R) top half of barrel; S) and T) gripper section to advance or retract leads; and U) magazine for leads

Pen and Pencil Parts – Inside and Out

WITH the exception of pen points, ball points, clips, and springs, which are still being fabricated of metal, there are few if any external or internal components of modern-day writing instruments that haven't either been completely taken over or penetrated to some extent by plastics materials.

Of the six basic components of fountain pens, for example, three—the barrel, cap, and the small connecting piece known in the trade as the "section" (see illustration above)—are virtually standardized in plastics; a fourth component, the feed, which serves to regulate the flow of ink to the writing nib, is frequently made of plastics; and a fifth part, the ink sac, represents a potential market for some of the newer, flexible materials (e.g. a polyethylene cartridge replaces the sac in Waterman's C/F fountain pen).

In the ball point pen market, the use of plastics is even more widespread. The replaceable ink-filled ball point pen cartridge, for example, which holds a supply of ink sufficient for several months' use, bids fair to become as universal a market for polyethylene as the ball point pen barrel has been for other plastics materials.

Because of the design of the ball point pen, many of the parts common to the fountain pen are eliminated. Since the tiny steel ball which serves as the writing point fits into a seat at the tip of the pen, the "section" is unnecessary and because most ball points are of the "push button retractable" type, very few of them have need for a cap.

From the standpoint of plastics usage, however, the ball point pen design makes up for this by using plastics extensively in the mechanical spring arrangements that retract the writing tip of the pen.

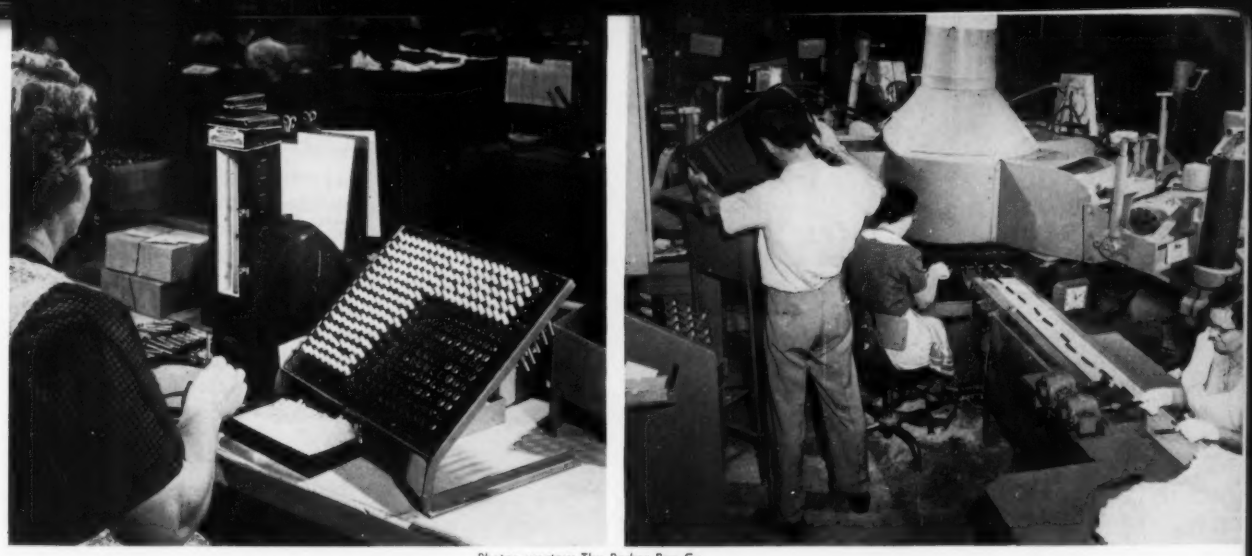
Similarly, plastics play an important role in the mechanical operation of the "propel-repel-expel" screw type pencil. By molding internal screw threads directly into the plastic pencil barrel or by molding them into a separate magazine that is then inserted into the barrel, manufacturers have eliminated the need for many costly machined metal parts.

These screw threads are necessary to the expulsion or retraction of the lead from the point of the pencil. When the operating section of the barrel of a mechanical pencil is turned, a metal gripper positioned inside the barrel and engaged with the spiral threads, moves the lead in or out.

The plastics which go into the construction of these parts of fountain pen, ball point pen, or mechanical pencil cover a wide range. To some observers, this variance may seem a paradox, especially in light of the extensive research facilities which most writing instrument manufacturers maintain.

Actually, however, many condi-

(*To page* 208)



Photos courtesy The Parker Pen Co.

Since precision fit of fountain pen and ball point pen parts is necessary to prevent leakage of ink under all conditions of use, plastics parts must be carefully molded to close tolerances. After molding, the dimensions of each part are checked by inspectors (left). If the parts (in the illustrations above, parts are pen barrels) satisfy requirements, they are fed into rotary-table buffing machines (right) where exterior surfaces are polished to a high gloss. Conveyor belt caries parts from machine to assembly line

plastics materials, but for many of the internal components and mechanical parts of these instruments —until recently made almost entirely of metal or rubber. It is in such parts that many of the newer plastics materials are finding an important market. At the present time, nylon, styrene alloys, styrene copolymers, polyethylene, and—newest of all—irradiated polyethylene, are among the plastics going into this phase of pen and pencil design. And rumors from behind locked laboratory doors of the tight-lipped industry give every indication that there is going to be considerably more expansion in this direction over the period of the next five years.

Modern writing instruments have been associated with plastics materials for so many years and with such success that today it is almost impossible to visualize ball point pens, fountain pens, mechanical pencils, or desk sets in terms of anything but plastics. In the 35-odd years during which plastics have been used in the manufacture of such instruments, nearly every form of thermoplastic and thermosetting material has, in one way or another, gone to market as an integral part of pen or pencil—and volume continues to grow year-by-year.

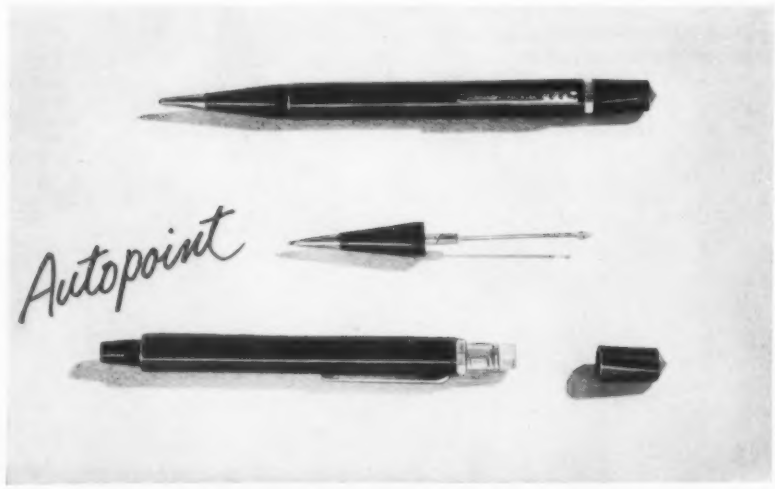
Exactly what this volume is, however, can only be guessed at. But on the basis of information gathered by the editors of MODERN PLASTICS during the preparation of this survey, it appears that it was *at least* between 3½ and 4 million lb. in 1954 and that the figure will be considerably higher in 1955.

Eight of the country's foremost writing instrument manufacturers were interviewed: Autopoint Co., Chicago, Ill.; Esterbrook Pen Co., Camden, N. J.; Eversharp, Inc., New York, N. Y.; David Kahn, Inc., North Bergen, N. J.; The Parker Pen Co., Janesville, Wis.; Scripto, Inc., Atlanta, Ga.; W. A. Sheaffer Pen Co.,

Ball point pen (right) has a molded nylon barrel (below, far right) and a molded nylon ratchet on the end of its ink cartridge (below, center)

Barrels for Wearever pencils (top row, left and center) and ball point (top row, right) and cap liners for fountain pen (bottom row) are butyrate. Fountain pen feed is acrylic

Translucency of polyethylene cartridge (center) for ball point pen ink enables user to keep track of how much ink is left. Barrel and cap of pen are molded of butyrate



Rugged compression molded phenolic barrel and end cap (bottom row) of mechanical pencil are more comfortable to the touch than metal. Cone (center) is also phenolic

Fort Madison, Iowa; and Waterman Pen Co., Inc., Seymour, Conn. The total estimated consumption of plastics which all eight anticipated for 1955 fell a little short of 5 million pounds. Add to this the amount of plastics which will be used by the other custom and proprietary pen and pencil parts manufacturers scattered throughout the country and the figure for 1955 will probably easily top the 5 million lb. mark.

Continued Growth

In 1956, the market is expected to grow even more. Several factors enter into this optimistic outlook:

1) Resurgence of the ball point pen market which, volume-wise, is the largest outlet for plastics materials. (Ball points in 1954 enjoyed a 22% sales rise over 1951).

2) Renewed developmental activities in the fountain pen and mechanical pencil field to meet the challenge of the ball points. If past performance of the industry is any criterion, such activity will be accompanied by an increase in plastics use.

3) Continued over-all growth of the pen and pencil industry. In 1952, a total of 194,316,000 fountain pens, ball point pens, mechanical pencils, and desk and dip pen sets were sold; in 1953, according to statistics published by the Fountain Pen & Mechanical Pencil Manufacturer's Association, the figure rose to 225,460,000. Estimates on 1954 sales are not yet available, but a similar growth pattern is anticipated.

Which Plastic?

Almost as paramount a question as the size of the writing instrument market is: Which plastic will capture the major share of the market and for how long? Of all the companies interviewed, not one would venture a guess.

While the career of plastics in the pen and pencil industry has been colorful and impressive, it has probably been more erratic than in most other markets. Ever since the early 1900's, when barrels were machined of casein or pyroxylin rod, the percentage of any one plastic material in writing instruments has not remained constant for very long.

Thus, even today, as manufacturers are adapting the newer plastics materials to pen and pencil design, the picture is changing radically.

The concept of polyethylene ink cartridges to replace metal cartridges in ball point pens, for example, has already started to swing through the industry, gaining more and more converts as it moves along. Similarly, developments in the use of nylon and styrene copolymers for barrels and gripping sections of fountain pens are being watched with interest.

Even irradiated polyethylene, at a time when *all* consumer applications of the material can be counted on the fingers of one hand, has turned up in the tip of an ink cartridge being used by Scripto for one of its ball point pens. After it is injection molded, the entire polyethylene cartridge is shipped to High Voltage Engineering Corp., Cambridge, Mass., where the tip is irradiated. The ball point unit is a press fit into this end of the cartridge; the irradiation eliminates any possibility of cracking under stress.

All this activity with the newer

(*To page* 92)

Sheaffer

Tube through which Snorkel is filled extends out of styrene-acrylonitrile "section"

Engineered for Perfection

ALTHOUGH basically simple contrivances, modern writing instruments, such as Parker's Liquid Lead pencil shown above, must go through precise manufacturing operations involving close adherence to small tolerances before they are ready to be marketed. Even as simple looking a part as the molded butyrate barrel for the new pencil necessitated months of research and experimentation.

The entire barrel, including molded-in internal threads, is injection molded in one piece. For molding the part, a 9-oz. injection machine was selected which had a large daylight opening for easy accessibility to parts and sprue and a variable press opening speed which would enable the unscrewing of the parts from the threaded core pins to be synchronized with the press opening cycle, thereby reducing cycle time and eliminating undue mold stress.

In designing the 12-cavity mold which was to be used for the job, several factors had to be taken into consideration. Because the barrel is an external part, a flawless finish on exposed surfaces was essential. Dimensions on cavity and core pin were also exceptionally critical; specifications called for tolerances of $\pm$0.003 inch.

To simplify the gearing necessary for unscrewing the parts, the mold that finally evolved makes use of a circular wheel type of pattern. The 12 cavities are equally spaced apart in a $5\frac{1}{8}$-in. diameter circle. Runners extending from the hub are trapezoidal $\frac{1}{8}$ by $\frac{5}{32}$ in., 7 degree angle sides, approximately $1\frac{7}{8}$ in. long. Restricted gating, 0.020 by 0.040 in., was used.

Turning of the arbor for unscrewing the molded piece is accomplished by a chain drive working off a gear box located on the press platen. The opening stroke of the press furnishes the necessary movement for this operation.

To hold the barrels steady while the threaded core pins are being unscrewed, shoulders at one end of the barrels are molded with 6 equally spaced grooves, $\frac{1}{32}$ in. wide by 0.006 in. deep. During the unscrewing operation, however, the barrels are moved out of the shoulder-forming cavities a sufficient distance to facilitate removal.

materials, however, is no indication that other plastics are going to lose the pen and pencil industry as a market. Butyrate (which some people claim is the current volume leader), acrylic, styrene, acetate, and polyvinyl chloride are going strong in many applications and give every indication of continuing to advance. Even cellulose nitrate, the "grand-daddy" of plastics in the pen and pencil market, is still being used for some applications by Esterbrook.

Ball Points

Volume-wise, the ball point pen is the most important of the three categories of writing instruments as a market for plastics. In 1953, approximately 122,517,000 ball point pens were sold, as compared to 40,134,000 fountain pens and 60,966,000 mechanical pencils (dollar value of the ball point pens, however, is considerably less than that of fountain pens). And, according to experts in the field, 99% of the ball point pens on the market use molded plastic barrels or molded mechanical parts.

Inferior ink dropped the ball point pen to the bottom of the consumer product heap in 1948; formulations have been considerably improved, and the ball point is once more surging into prominence. One manufacturer reports that this year he is producing 2 million steel balls a week for pens of this type.

For the plastics industry, this growth is good news. Most of the ball point pens sell in the $1 and $2 class and the mass production economies inherent in the use of plastics parts figure prominently in the industry's plans. Even the more expensive ball points are adopting plastics materials. Parker's Jotter, for example, is one of the first writing instruments to make use of a molded nylon barrel.

And the use of polyethylene tubing as the ink cartridge is making sweeping strides. The flexible tubing is especially adaptable to this application because of its transparency and "non-wetting" characteristics. As the ink is used up, the level of the ink column goes down, showing at a glance exactly how much liquid is left. If the polyethylene had "wetting" characteristics, a film of ink (sometimes accounting for as much as 12% of the ink supply) would adhere to the inside wall of the cartridge, block out the transparency, and prevent the full supply of ink from running down into the feed.

Fountain Pens

At the same time, designers of fountain pens have been far from idle. Fountain pen makers, in the past few months, have been fighting the revival of the ball points with new models of their own.

Two of these new models stand out: Sheaffer's Snorkel and Water-

C/F fountain pen does not have to be filled from ink bottle. For a fresh supply of ink, a hermetically sealed, leak-proof polyethylene cartridge is simply slipped into place

Plastics parts of C/F include: styrene-acrylonitrile cap liner and barrel; polyvinyl formal hub; cartridge; and Teflon-coated spring

Special equipment is used to fill the polyethylene cartridge with ink and to seal the open end with a polyethylene-lined metal cap

man's cartridge-filled pen. Both are basically designed to overcome what is seen as the prime disadvantage of fountain pens in comparison to ball points—the fact that fountain pens have to be frequently filled with ink, an operation that can be somewhat messy.

The Snorkel pen makes use of a thin metal tube hidden under the nib. When the opposite end of the barrel is turned, this tube extends out of the nib. After a fresh supply of ink is drawn up through the tube, another turn of the barrel end retracts the Snorkel tube.

In the design of the Snorkel pen, several plastics parts play leading roles: 1) a gripping section molded of nylon or styrene-acrylonitrile; 2) barrel and cap molded of styrene-acrylonitrile; and 3) O-rings molded of nylon.

According to Sheaffer engineers, key to the success of the Snorkel is the gripping section which is molded with two outside threads, one inside thread, and three splines. A mold was designed which could produce this part in one molding, thereby effecting a considerable reduction in production costs.

Because of the precision assembly necessary for the Snorkel filling mechanism—tolerances on some parts run as small as ±0.001 in.—the moldability of styrene-acrylonitrile and its exceptional dimensional stability were essential to the success of the pen design.

The molded nylon O-rings are used to effectively leakproof all joints.

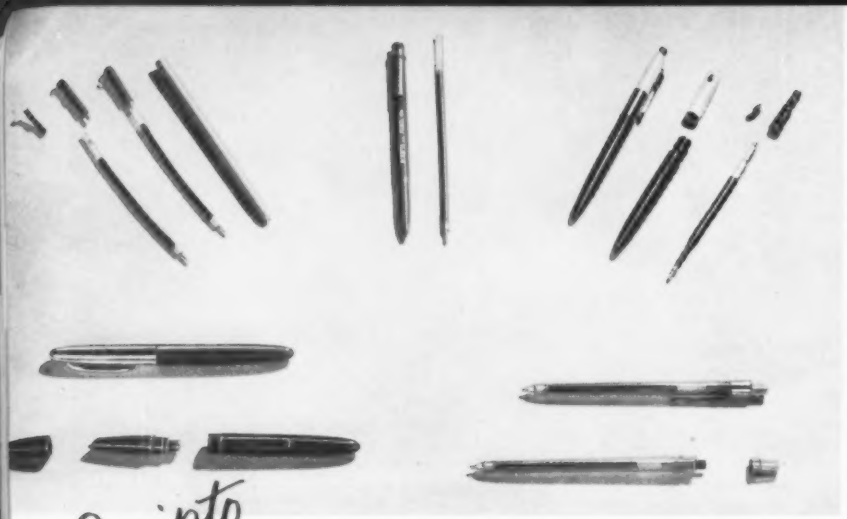
Cartridge-Filled

Waterman's C/F, which has a conventional fountain pen nib, and is claimed to combine the best features of the fountain pen and the ball point pen, is almost entirely a plastics development. Basic to the design is an extruded-molded polyethylene ink cartridge filled with regular fountain pen ink. When the pen "runs dry," the used cartridge is removed and a new one simply inserted in its place.

Manufacture of the polyethylene cartridge is a unique operation. Polyethylene tubing, extruded to the required diameter and cut to length, is placed in a mold and a solid polyethylene head is injection molded over one end. The tubes pass from the injection machine to

Fountain pen desk set (top) makes diversified use of many plastics materials. With exception of glass base, set is almost all plastics, including (bottom, from left to right): phenolic closure; styrene indicator ring; polyethylene capillary unit with nylon monofilaments; acrylic taper; and machined vinyl sleeve and "section"

Many fountain pens and mechanical pencils in the Esterbrook line are based on the same type of plastics construction: nitrate barrels and caps; machined vinyl "sections" for fountain pens; and molded nylon end buttons dyed to specified colors



Scripto

Fountain pen barrel (bottom, left) is butyrate; Liquid Lead pencil barrel (top, center) is acetate; barrels for ball points are molded of butyrate or styrene

Metal tips are placed on the ends of threaded mandrels and translucent styrene pencil barrels are molded around them. Mandrels unscrew from the barrels as the mold opens

Photos courtesy Scripto, Inc.

Pencil barrels, as removed from the mold, need only be degated before reaching the assembly line. Molded-in spiral threads eliminate need for costly spiral metal tubing

a special filling and capping unit, where, as each cartridge is filled with ink, a metal cap with a molded polyethylene inside liner is placed over the open end and crimped into place.

Ruggedness of polyethylene makes the material ideal for these cartridges (advertising states that they "cannot break or leak"); in addition, the flexibility of the 0.022-in. wall of the cartridge makes it possible, in the event that a new cartridge is not at hand, to refill an empty cartridge by simply dipping the pen point into ink and squeezing the tube.

Other plastics parts of the C/F are: barrel and cap liner molded of styrene-acrylonitrile and a hub assembly molded of polyvinyl formal. According to Waterman engineers, polyvinyl formal was chosen for this part, which contains the metal pin that pierces the top of a new polyethylene cartridge as it is inserted, because of toughness and resistance to cracking under internal stress. The metal pins are placed as inserts in the mold and the hub assemblies are molded around them. A metal spring located inside the "section" is coated with Teflon to reduce friction and abrasive action.

Mechanical Pencils

In the form of molded colorful barrels with integral spiral threads, plastics have been associated with mechanical pencils almost from their very beginnings. And plastics bushings, connections, and push buttons are credited with many recent refinements in operation.

One outstanding example of the contribution of a molded plastic part to the performance of a mechanical pencil—and at a considerable savings in cost—is a molded butyrate magazine for leads recently introduced in one Scripto model.

The one-piece, lightweight plastic unit, which incorporates molded-in spiral threads, replaces a metal mechanism made up of four separately machined parts. (See photos and drawing, p. 87.) The metal mechanism cost 12¢; the plastic part —½ *cent!*

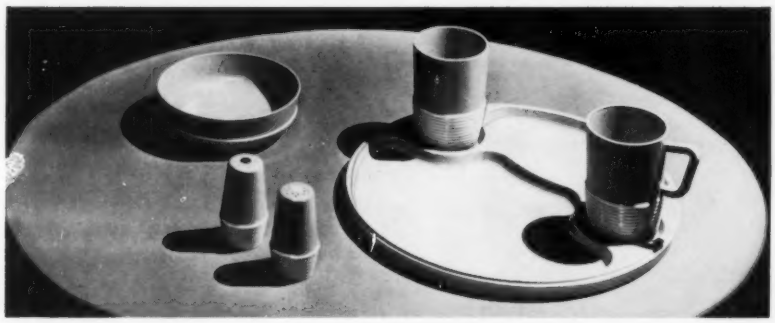
The plastic magazine is not only lower in cost and more efficient than its metal counterpart, but it is also lighter in weight, requires no assembly operations, is more shock

(*To page* 212)

KOPPERS' DESIGN COMPETITION

From 179 entries by 77 molders, three winners and six honorable mentions were selected

FIRST PRIZE (UTILITARIAN, OPERATIONAL): To Federal Tool for two-tone, drop-door breadbox molded of high-impact polystyrene



FIRST PRIZE (UTILITARIAN, NON-OPERATIONAL): To Burroughs for 18-piece starter serving set of Luau dinnerware, molded of polystyrene in two-color combinations

All photos courtesy Koppers Co., Inc.

FIRST PRIZE (DECORATIVE): To Injection Plastics for glossy, rectangular shaped styrene shelf planter with base trimmed in gold

AS A major part of a program to promote correct design and proper application of plastics in consumer products, a nation-wide design competition for molders of styrene housewares was recently instituted and conducted by Koppers Co., Inc., Pittsburgh, Pa. From among the 179 entries submitted in the competition by 77 molders, a single first-prize winner was selected in each of three separate divisions. Two honorable mention awards were also made in each classification.

The three-man judging panel, which selected the winners on the basis of the design features, quality, and imagination displayed in their products, consisted of Clare E. Hodgman, Raymond Loewy Assoc.; Dr. Jesse H. Day, editor of *S.P.E. Journal;* and Dr. Hugh G. Wales, professor of marketing, University of Illinois. In keeping with the general theme of encouraging the upgrading of plastics products, the awards presented to the first-prize winners were unique in that they were intended to benefit plastic product designers of the future. Top awards were one-year, full-tuition scholarships paid for by Koppers and issued in the name of the winner in each of the three divisions to the school of the winner's choice.

Top award in the category devoted to utilitarian products with operative construction features went

(*To page* 227)

PLASTICS SIGNS FOR MODERN TRAFFIC

AS MORE and more automobiles take to the road year by year, the function of the highway sign in traffic control has become increasingly important. And in the light of modern highway speeds and the complex intersections and interchanges which characterize today's thruways and speedways, such highway signs, in order to be effective, must be recognized and understood at a glance.

In many areas in the United States, particularly in those where adverse weather conditions severely attack paint or lacquer, the problem has become acute and it is today being met by the installation of plastics highway signs.

Maintenance Costs

Where wood, metal, or porcelain enamel highway signs are used, maintenance costs run high. In order to insure perfect readability, it is necessary to continuously inspect such signs, touch up or completely repaint those in which the paint has faded or chipped, and replace or repair those that have been bent or damaged in some way by accidents or vandalism. Multiplied millionfold by the number of highway signs in existence today, such maintenance costs can run excessively high. In 1954, the Bureau of Public Roads estimates that nearly $1¾ billion was spent on maintenance of highways and roads by federal, state, and local agencies and that much of this involved the replacement or repair of highway signs.

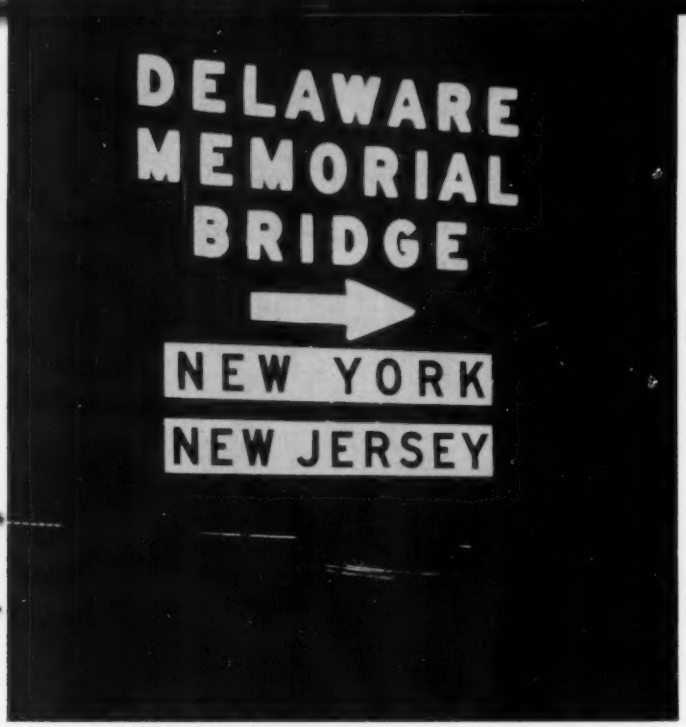
Courtesy Rohm & Haas Co.

During the daytime, formed translucent acrylic letters—in bright, easy-to-see colors—enable highway sign legend to be recognized and understood at a glance . . .

By taking advantage of plastics highway signs, traffic engineers have found that such maintenance costs can be drastically cut. Plastics signs as such, whether they involve the use of acrylic, polyester-fibrous glass laminate, vinyl, or styrene copolymer, have several inherent advantages that make them ideally suited for highway applications.

For one thing, color is integral with the plastic piece so that the need for retouching or repainting is completely eliminated. Colors always remain fresh and bright for increased visibility and where the translucent materials, such as acrylic, with their excellent optical qualities are used, legibility and visual impact are outstanding.

Unlike metal or porcelain enamel



Courtesy Rohm & Haas Co.

. . . at night, the translucent letters can be backlighted for equally effective visibility. Letters are resistant to weathering and breakage

Photos courtesy Perry Plastics, Inc.

Rugged reinforced plastics signs are better able to withstand acts of vandalism (above and below) than most other types of signs available today

Drastically lower maintenance costs, better resistance to weather, improved legibility, and ability to absorb abuse are reasons why a huge new market is open for plastics highway signs

signs, the plastics signs will not chip or rust and are unaffected by extremes of weather. The exceptional strength of the plastics signs and their resistance to breakage have also proved of value as a deterrent to the action of vandals.

Although the concept of plastics signs is not new—some have been on the market for over 5 years—most of the leaders in this industry seem to feel that this is the year in which the application will start to reach the really fabulous potential that everyone has been predicting.

The reasons for this optimism are

Reinforced plastic sign panel is removed from mold with the aid of vacuum cups (left); legend is silk screened on the surface of the sign with weather-resistant inks (right)

Photos courtesy Perry Plastics, Inc.

Photos courtesy B. F. Goodrich Chemical Co.

Designed to replace conventional metal street signs, units formed of rigid vinyl sheet will not chip or rust and require little or no maintenance

well founded. The federal, state, and local agencies that are responsible for the purchase of highway signs are, after all, political groups notoriously slow-moving in cutting through red tape to accept anything non-conventional. Consequently, for the past three to four years, in nearly every one of the 48 states, experimental plastics signs have been installed and carefully watched as to how they stand up under actual field conditions.

In recent months, as these tests have come to an end, the number of reports published on experimental plastic sign installations have increased in frequency—and thus far, they have all been good. So good, in fact, that most of the manufacturers of plastics signs are expecting to base increased promotional activity in 1955 on the enthusiastic reaction of government officials to the signs.

In addition, many raw material suppliers, molders, and fabricators seem to have become more aware of the potential of this market than ever before and are devoting special effort to developing materials and production techniques more ideally suited to the specialized requirements of this application.

Just how big this market actually is is indicated by the fact that more than 3 million miles of federal, state, and local roads exist in the United States today and that the number of signs used on these thoroughfares runs well into the millions. In Connecticut alone, for example, there are over 75,000 signs and in Pennsylvania, the number easily tops 1 million. Even more important is the amount of money which it is estimated government agencies will pour into building new roads in the future. In 1954 alone, over $3¾ billion was spent on road and highway construction.

Of the many plastics materials now going into highway sign applications, the acrylics were one of the first to invade the field. They still enjoy exceptional popularity and the amount of material going into highway signs seems to increase with each passing year.

Acrylic Signs

One of the basic reasons for the use of acrylic for these applications is found in its optical qualities which make for excellent visibility even at a distance during the daytime. Acrylic signs can also be backlighted at night for high effectiveness. In addition, because acrylic is easy to fabricate, is available in a wide range of colors, and is light in weight, it offers the traffic engineer broad flexibility in sign design and in the choice of mounting methods.

The State of New Jersey Highway Department is one of the agencies now making use of acrylic signs. On all overhead neon-lighted electrical signs, for example, metal units are being replaced by signs consisting of a backlighted white translucent acrylic panel to which are attached cast aluminum letters mounted on a sign track. The Port of New York Authority is also making use of acrylic for directional signs on super highways. These signs consist of a metal light box faced with a white translucent acrylic panel on which the legend has been painted. The signs are also being installed in heavily congested areas, such as mid-town Manhattan, as a replacement for the bronze-faced light boxes with glass letters which often lost their identity among the jumble

Testing reflectability of reinforced plastics sign panels to determine the efficiency of the sign surface. In test set-up, board at left simulates the surface of the road

Courtesy The General Tire & Rubber Co.

of commercial and municipal signs common to this area.

In addition to their optical advantages, the acrylic signs are highly resistant to weather and breakage.

Reflecting Signs

One of the biggest outlets for acrylic in the highway sign field is in the design of reflecting signs to replace those units made with conventional glass button reflectors.

Reflexite Corp., Stamford, Conn., is one company currently marketing a specially molded acrylic sheet for just such a purpose.[1] Using powder supplied by Rohm & Haas Co., the sheet is molded for Reflexite by Waterbury Cos., Inc., Waterbury, Conn., on a specially designed mold which produces about 2900 miniature lenses on each square inch of material surface. These tiny, but optically accurate, lenses are on the side of the acrylic sheet which faces the viewer of the sign.

On the opposite side of the sheet, which is the focal plane of the lenses, a transparent lacquer with resistance to ultra-violet light is sprayed on. The back is then vacuum metallized with aluminum and a coat of varnish is applied.

When the headlight beams of an on-coming car strike the lens-covered side of the sign, they are focused to myriad pinpoints on the reflecting surface, then reversed in direction and sent back in concentrated parallel rays towards the approaching car.

The reflecting highway sign ma-

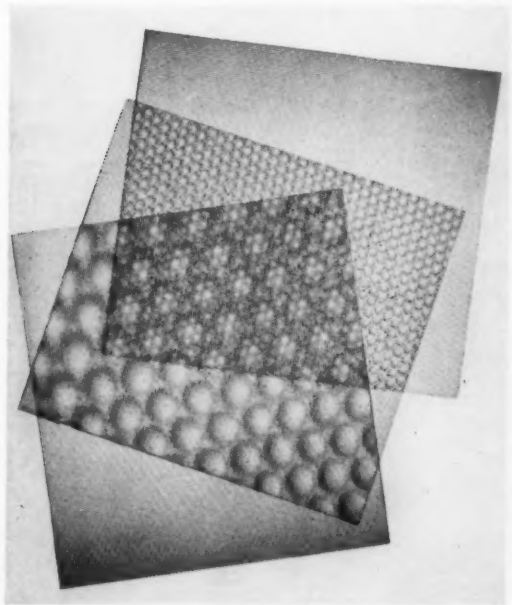
(*To page* 222)

[1] "Acrylic Reflecting Signs," MODERN PLASTICS *26*, 63 (Feb. 1949).

Molded acrylic letters with excellent reflecting properties replace glass button reflectors in highway signs

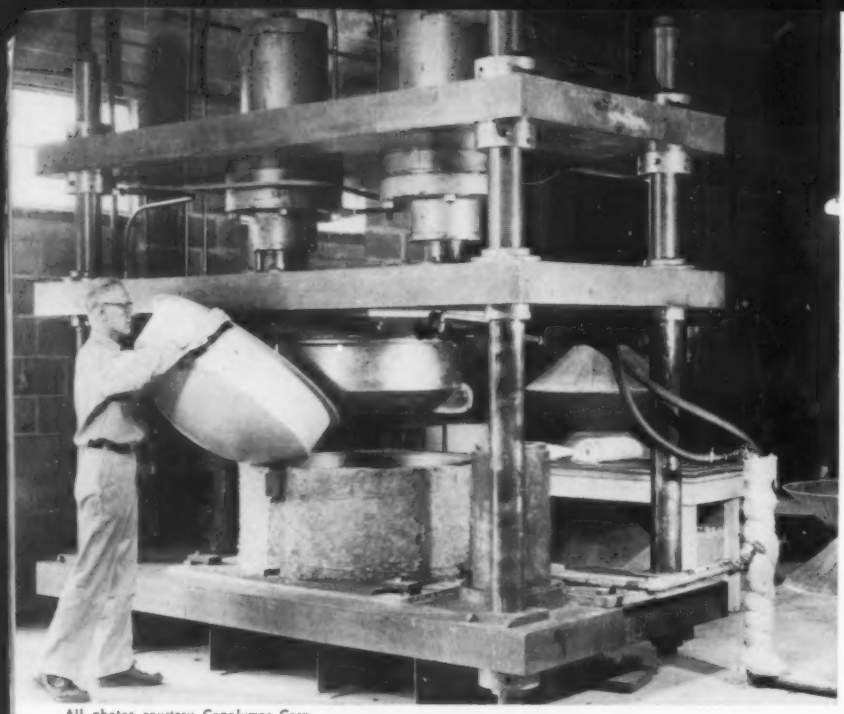
Illuminated by headlights alone, the reflecting acrylic letters are easily readable even at considerable distances

Photos courtesy Rohm & Haas Co.



Millions of tiny lenses molded into the acrylic panels are the reflecting medium for the highway sign letters

Individual letters are cut with steel rule dies out of the 8- by 9-in. molded acrylic sheet and mounted on panels



All photos courtesy Copolymer Corp.

Reinforced plastics tank head section being removed from 250-ton press. It will be assembled to other reinforced parts at point of use to produce a complete tank set-up

Press-Molded Tanks in Mass Production

Standard components of fibrous glass and resin, produced in polished steel mated dies, can be readily assembled on the job

A NEW approach to both the economics and the engineering of reinforced plastics tanks for storage and dispensing of distilled water, acid solutions, fuel oil, and other problem liquids is proving successful at Copolymer Corp., Los Angeles, Calif.

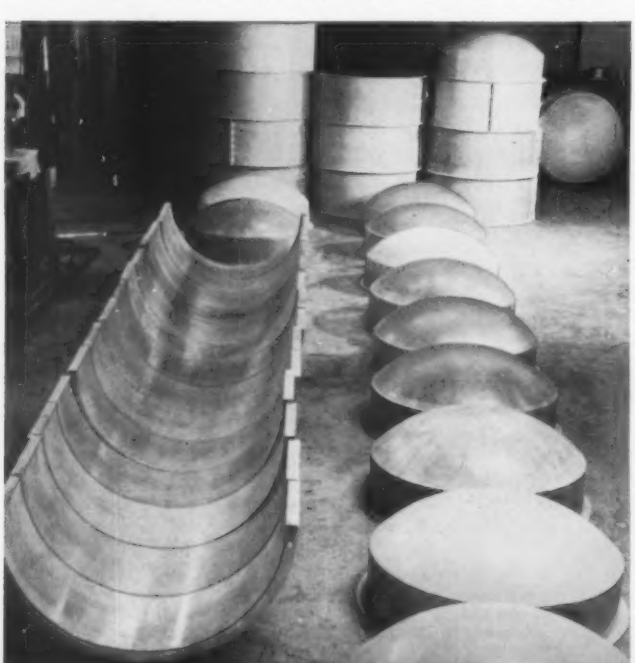
Discarding former premises that monocoque stressed construction was the proper way to make tanks, and ignoring the school of thought which leans toward hand layup, low pressures, and low-cost tools, the company designed and engineered a set of standard components which can be press-molded in steel dies direct from mat and which can be assembled to form standard-size tanks on the job at a great saving in cost.

The tanks are built up from two basic components: domed head or end sections, and half circles, both flanged. The half circles are permanently joined at the ends to form circular tank segments, the joining being accomplished at the flanges by resin sealing plus the use of stainless steel rivets.

The tank segments are bolted together circumferentially with neoprene gaskets between the flanges, and the end pieces are similarly applied when the desired length has been obtained.

The parts are molded on polished steel cut-off dies, steam heated and mated so as to mold a 0.100-in. wall thickness. The end piece mold is 36

Standard mass-produced tank components include flanged semi-circular wall sections (left) and end pieces; several partial assemblies are in background



Head section is assembled to circular tank segment consisting of two semi-circular wall sections joined together along flanges

in. in diameter and 16 in. deep and the freeboard area of the head is 8 in. straight draw without any draft or taper. Molding pressure is 170 p.s.i. Parts are removed from the mold complete, trimmed, and ready to ship.

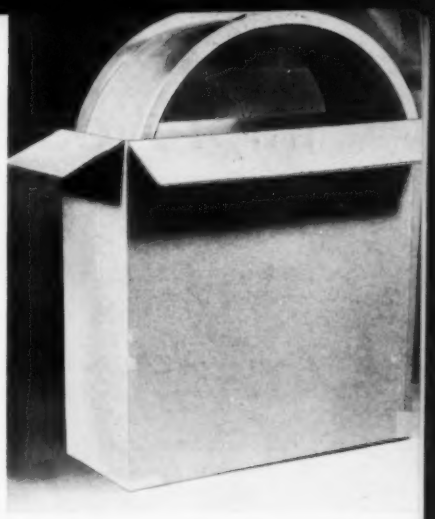
The press and molds were designed and made in the Copolymer Corp. plant. The press was built around standard Hanifin cylinders and uses Vickers hydraulic power equipment.

Engineered Fittings

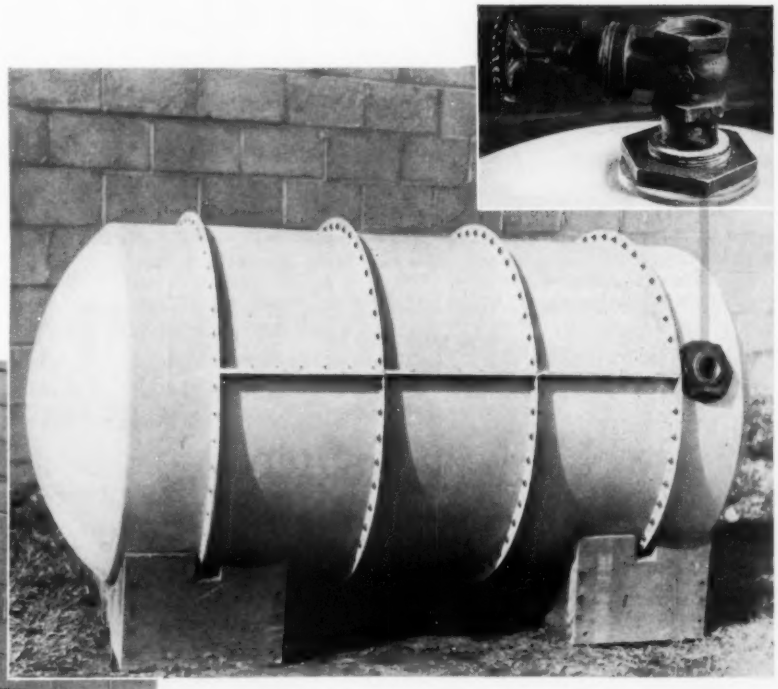
The application of fittings to these tanks is easy because of the engineering. Fittings are molded of glass mat and polyester resin, with either a cylindrical radius or a spherical radius to fit the ends or sides of the tank. To install, a hole is cut in the desired location with a hand drill and a hack saw and the flanged fitting, tapped for 2-in. pipe threads, is pushed through the hole. A matching pad is then placed over the fitting on the outside and, finally, a standard jam nut is screwed on to the outside threads.

The economies of this form of tank engineering is apparent in the company's price list. End sections cost $28, center sections $40, flat bottom plates $16, baffles $12, and fittings $4. Since the parts are standard, a circle segment or an end piece may be cartoned for a charge of only 80¢, which means that a 500-gal. tank can be packed for shipment for $5.60. The completed tank, assembled in its use location costs less than almost any metal tank.

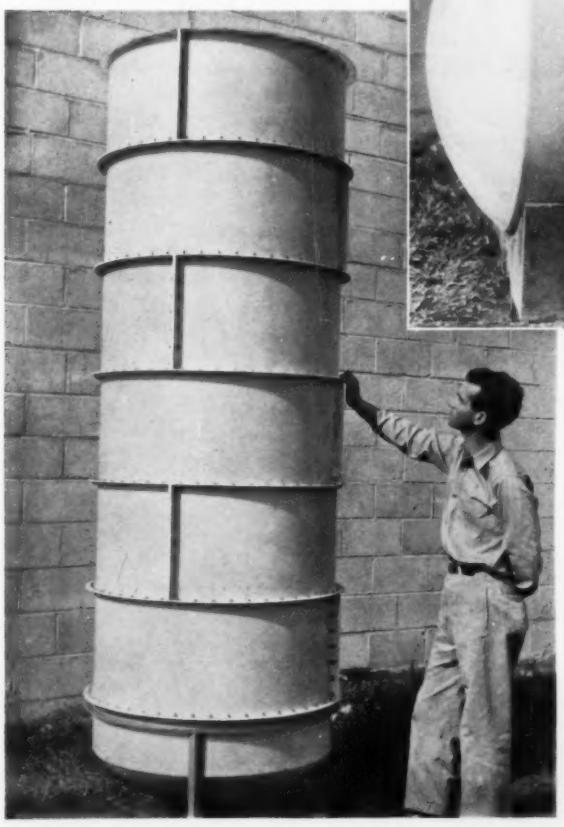
Due to the flexibility of the design, cylinders may be used without end pieces to make chemical scrubbing columns, tanks may be expanded in size by the addition of new segments, and half-cylinders can even be made into cattle watering troughs.



Tank components are easily shipped to sites of assembly in handy cartons



Capacity of this reinforced plastics tank is 300 gal., weight is 105 lb.; tank has been equipped with fitting for installation of gate valve (see inset at top)



This tank, assembled of components shown on opposite page, is capable of holding 500 gal. of water. It is held in an upright position by a ring stand and the 4100-lb. load is concentrated at bottom flange

Improved Radiation Reader

Molded phenolic components, replacing die-cast aluminum pieces, provide better performance at lower cost

FIVE phenolic parts molded to extremely close tolerances contribute light weight, dimensional stability, and excellent surface finish to the precise operation of a dosimeter-reader unit made by the Specialty Engineering Div. of the Specialty Assembling and Packing Co., Brooklyn, N. Y.

The delicate function of the reader unit is to measure total accumulated exposure to radiation as recorded on radiation-sensitive dosimeters. Essential to the operation is a positioning device made up of the phenolic parts. Die-cast aluminum pieces had previously been used but, in replacing the metal with plastics, the manufacturer claims not only a considerable savings in cost but also more effective performance.

In view of the fact that radiation effects on human beings are sometimes delayed—often as much as 24 to 72 hr. after exposure—the dosimeter measurement system can be used during disasters caused by atomic blasts to provide a quick means to determine whether exposed personnel will be able to carry out their duties or will require immediate treatment.

To measure total radiation exposure, the dosimeter to be tested is simply inserted into the phenolic positioning device in the reader unit and a meter reading gives the answer.

Positioning device in front panel of dosimeter-reader unit for measuring total radiation exposure (top) is made up of five separate parts (bottom) precision molded of phenolic. Molded-in grooves in each part contribute to snug-fitting, lightproof assembly
Courtesy Durez Plastics & Chemicals, Inc.

Savings in Costs

According to the manufacturer, the savings in costs as a result of replacing the metal positioning system with a plastic one were many. Although five different molds are used in turning out the parts of the system, it has been estimated that mold costs, when compared to those required for die-cast aluminum, were cut approximately in half. The phenolic system is also lighter in weight than the comparable metal unit and the per-piece price of the parts are considerably less than those of aluminum.

Other basic advantages of the molded parts were twofold: better color and surface finish and excellent dimensional stability. Since there must be no reflection of internal light within the reader unit, the black color of the phenolic parts is important. The metal parts previously used required finishing to attain this objective. In addition, the surface finish of the molded parts, just as they come from the mold, is considerably better than that of parts made by die-casting.

The most important reason for the selection of phenolic, however, according to the manufacturer of the reader unit, was the material's dimensional stability.

The positioning system has to be designed in such a way that no light enters the reader as the dosimeters are inserted. An earlier model used a door; the snug-fitting grooves of the phenolic pieces are molded to such close tolerances that no door is necessary. The assembly is completely lightproof and can actually be operated more quickly and easily than the earlier model which used metal parts.

CREDITS: Phenolic supplied by Durez Plastics & Chemicals, Inc., North Tonawanda, New York.

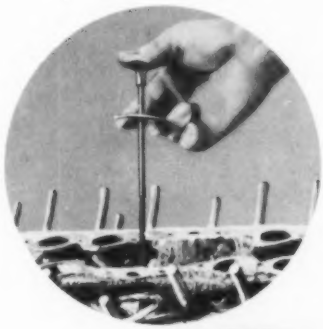
NEWS AND VIEWS OF PLASTICS PROGRESS

STOKES *plastics review*

VOL. 4
NO. 2
1955

PUBLISHED BY F. J. STOKES MACHINE COMPANY, PHILADELPHIA 20, PA.

Growing Plastics Molding Business Operates on Day-Night Schedule with Stokes Fully Automatic Press



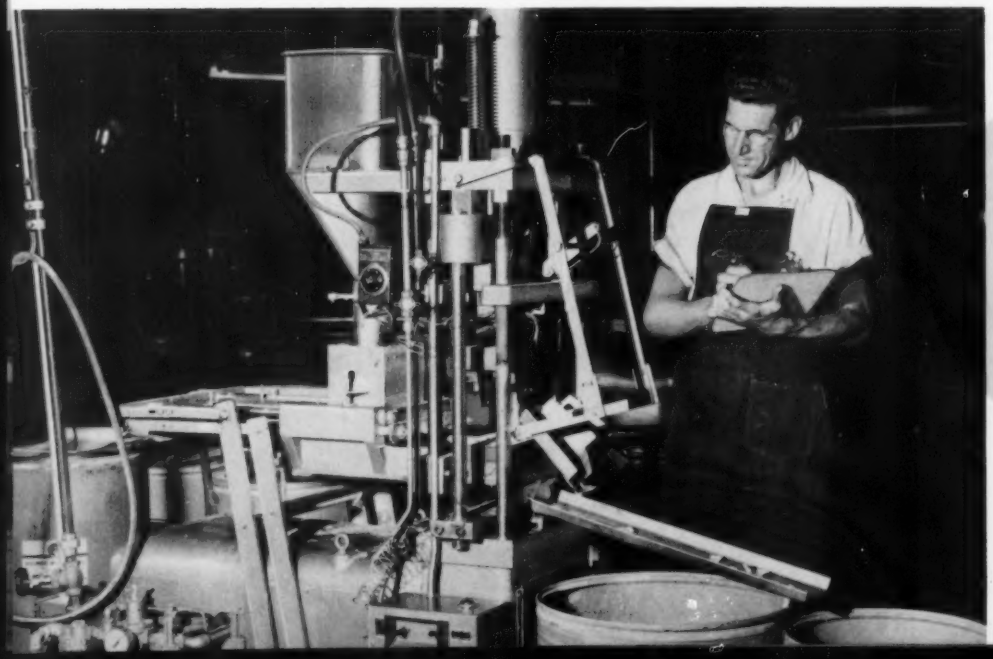
Back in 1946 R. F. Kolde and J. M. House founded Western Controls Corporation in Wichita, Kansas. Mr. Kolde was president and sales manager; Mr. House vice-president and production manager.

Their object was to make control members for automobiles, garden tractors, power lawn mowers, choke, throttle and other elements of dash panels. Some of the controls seemed to demand plastic knobs so first thing they knew they were in the plastics business making not only their own knobs but knobs and other plastic parts for many customers.

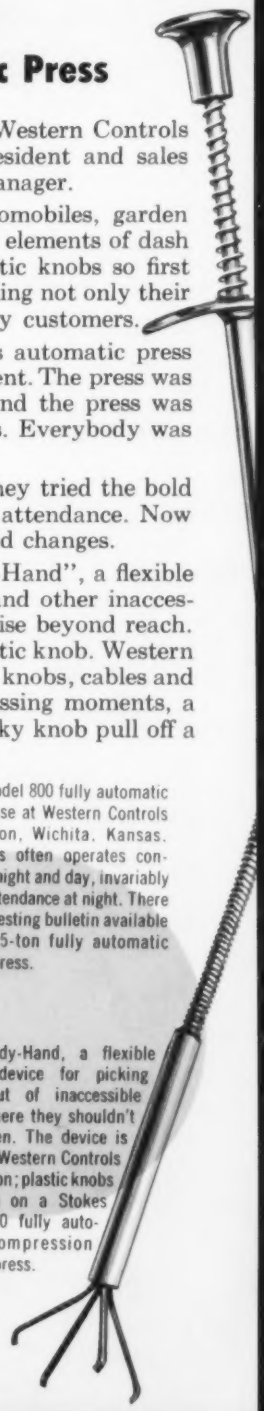
The arrival of the company's new Model 800 Stokes automatic press some time ago was an occasion of promise and excitement. The press was set up, mold put in place, air and power connected and the press was turning out perfect finished parts in less than 8 hours. Everybody was happy and has remained so ever since!

After a few weeks of uniformly successful operation they tried the bold experiment of overnight operation without benefit of attendance. Now the press runs practically continuously except for mold changes.

One of Western's interesting products is the "Handy-Hand", a flexible pick-up device to reach into sink drains, crankcases and other inaccessible spots to retrieve small objects which are otherwise beyond reach. They are strong and durable with a rigidly secured plastic knob. Western Controls lays a great deal of emphasis on the joining of knobs, cables and conduits so that they do not come apart at embarrassing moments, a comforting thought to anyone who has ever had a pesky knob pull off a wire or cable.



Stokes Model 800 fully automatic press in use at Western Controls Corporation, Wichita, Kansas. This press often operates continuously night and day, invariably without attendance at night. There is an interesting bulletin available on this 15-ton fully automatic molding press.

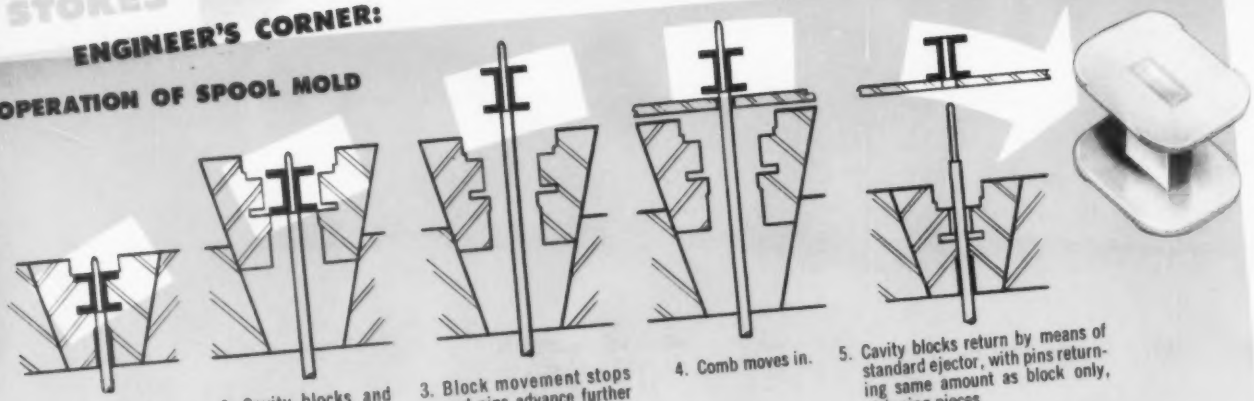


The Handy-Hand, a flexible pick-up device for picking things out of inaccessible places where they shouldn't have fallen. The device is made by Western Controls Corporation; plastic knobs are made on a Stokes Model 800 fully automatic compression molding press.

STOKES

ENGINEER'S CORNER:

OPERATION OF SPOOL MOLD



1. Mold opens.
2. Cavity blocks and pins move up by standard ejector.
3. Block movement stops and pins advance further by special secondary ejector.
4. Comb moves in.
5. Cavity blocks return by means of standard ejector, with pins returning same amount as block only, stripping pieces.

Coil Forms Now Molded Automatically with Remarkable Economy

For years, one problem which has seemed almost beyond solution has been the automatic molding of coil forms from thermosetting plastics. These spools, with flanges top and bottom, have long been made on semi-automatic presses but seem to have defied adaptation to more economical fully automatic production. In some cases, where the end application of the coil form permits, thermoplastics have been used to make these parts on Stokes truly automatic injection molding machines with notable economy.

Due to the shape of coil forms—used for the windings in all sorts of electrical devices and controls—the mold must be split, with side-draw away from a single row of cavities. This has been the crux of the problem, since the platen of the press must be large enough so that an economical number of cavities can be used. Semi-automatic presses, though they have a large platen area, could not be fitted with enough cavities to offset their high labor charges. The Model 741 fully automatic compression molding press gave Stokes engineers the answer to these problems. Another feature that makes the 741 particularly attractive for this adaptation is the standard cylinder in the bottom of the press, unique in the field. This cylinder is used to move the mold halves up and away from the molded coils, allowing them to be ejected without damage. Two additional hydraulic cylinders are added to give the required motion of ejection and retraction to the core pin so that the spools can be positively ejected by the mechanical comb of the press. Other adaptations are adjustable air blasts to clean flash from the mold and redesigned safety checks for the new press sequence.

Cost studies on a 741 press with a six-cavity side-draw mold showed that the cost of finished pieces, molded from general purpose phenolic, was only $2.35 per thousand, plus, of course, the overhead which varies with each molder's operations.

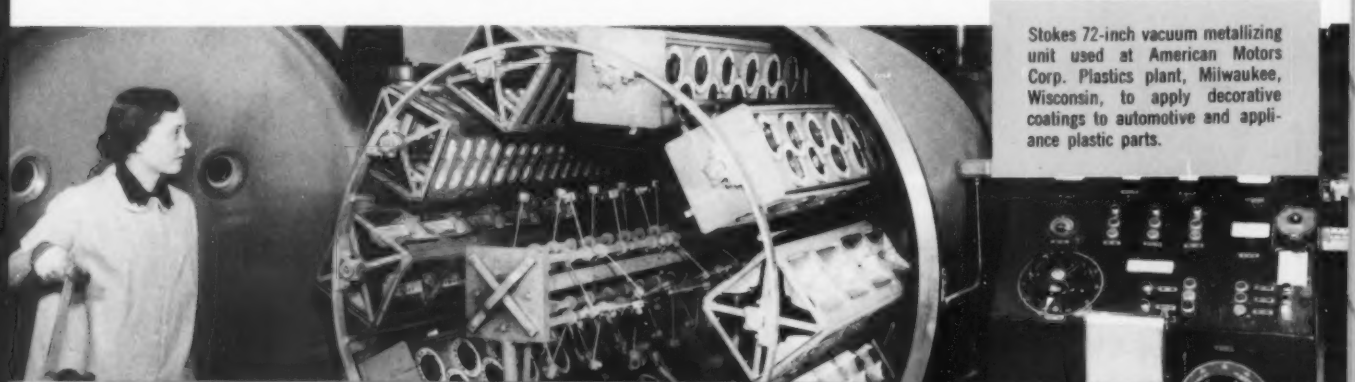
The first Model 741 press to be equipped with this side-draw mold has been shipped to a molder in Chicago. It is an important forward step in the art of plastics molding and will enable molders to cut their production costs on coil forms of all sizes.

Vacuum Plated Refrigerator Parts Help to Sell Modern Kelvinators

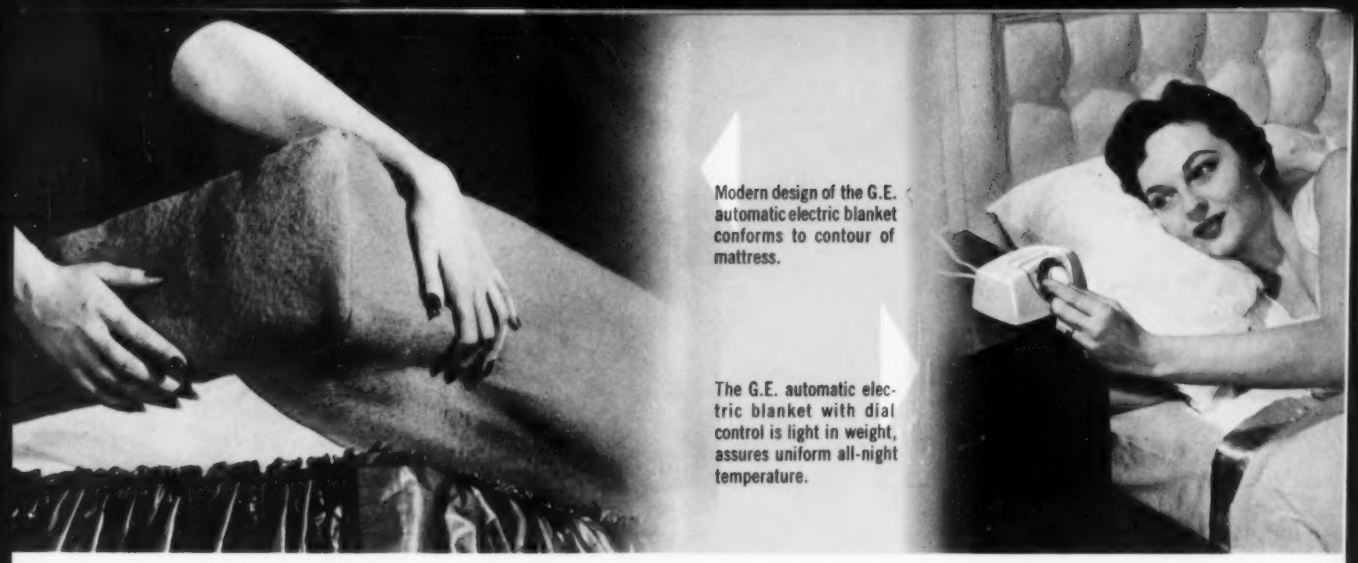
Freezer-chest doors, name plates and medallions, door shelves and butter and cheese compartment doors for Kelvinator refrigerators require a brilliant metallic finish. This type of part has traditionally been an electroplated metal stamping; later a sprayed plastic for decorative purposes. They are now most efficiently and inexpensively finished by vacuum metallizing which produces a dramatic, three-dimensional effect.

Several hundred of the different pieces to be metallized are handled in each batch at the Milwaukee Plastics plant of American Motors Corporation. Each batch of pieces is mounted on fixtures outside the metallizing chamber while the previous batch is being metallized. The interchangeable racks are quickly exchanged, the finished pieces ready for lacquering and assembly and the next batch ready for metallizing.

In the Stokes Vacuum Metallizer, the steps of the operating cycle—drawing vacuum, raising temperature of tungsten filaments, flashing of the aluminum staples—are automatically controlled by pushbutton operation from the control panel to be seen at right of the adjacent picture. An informative brochure with a handsome metallized cover is available on request.



Stokes 72-inch vacuum metallizing unit used at American Motors Corp. Plastics plant, Milwaukee, Wisconsin, to apply decorative coatings to automotive and appliance plastic parts.



Modern design of the G.E. automatic electric blanket conforms to contour of mattress.

The G.E. automatic electric blanket with dial control is light in weight, assures uniform all-night temperature.

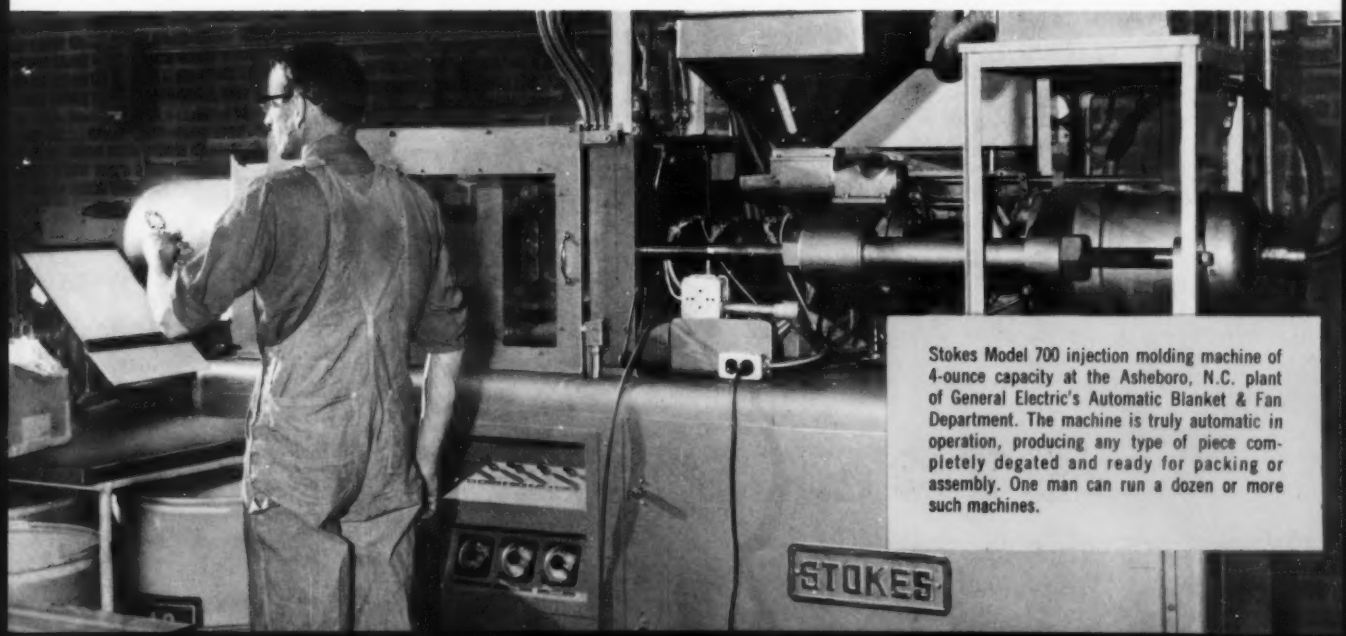
Control Parts of Popular G.E. Electric Blankets Made on Stokes Truly Automatic Injection Molding Machine

Next thing you know G.E. will be making automatic Lampyridae photuris (fireflies) for lawn parties. Up to now, however, they haven't been able to make light without heat. But they do a fine job on automatic electric blankets, which are definitely heat without light and with remarkably little weight. One light blanket with the modern contour corners at the bottom of the mattress, one setting of the dial on G.E.'s automatic control and the somnolent citizen is ready for a night in a uniform heat zone.

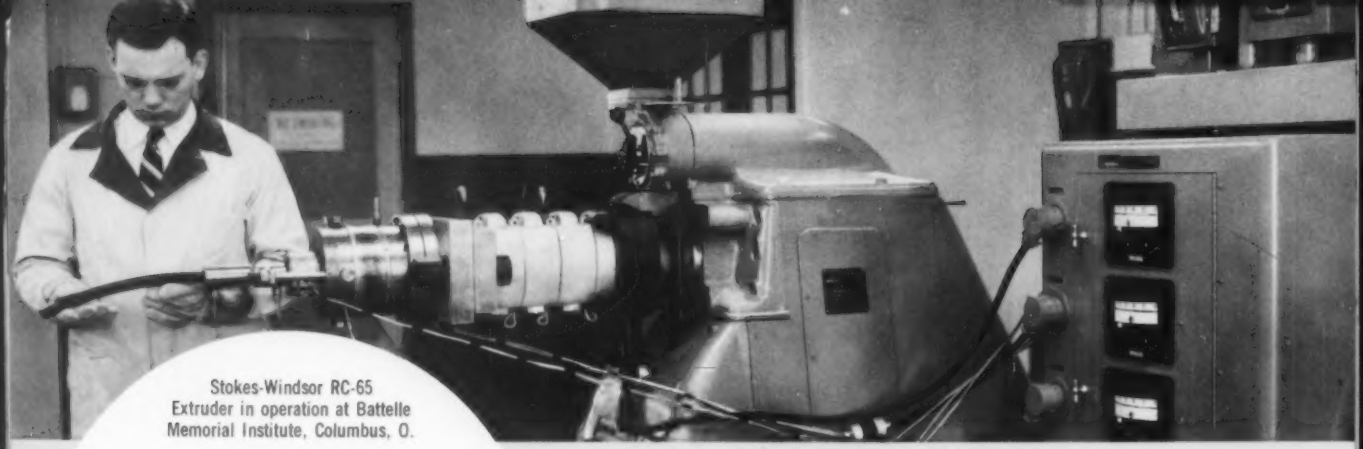
One of the little elements that contributes to the success of this modern convenience is the switch case that stands within arm's reach to permit adjustment of temperature. Parts of it are made at General Electric's Automatic Blanket & Fan Department plant at Asheboro, N.C., on a Stokes Model 700 injection molding machine of 4-ounce capacity. This is one of numerous machines of the type that have now been in use for four years.

Injection molding, to be sure, is not new, nor is so-called "automatic" injection molding. But this new Stokes injection machine has truly novel characteristics. *Any* type of part within the capacity of the machine can be molded automatically. The molded parts are positively ejected by a mechanical comb and they are automatically degated. Parts leave the machine ready for packing or assembly without hand work or further finishing operations of any kind.

It is literally true that one man can operate a dozen or more of the Stokes injection machines, having only to replenish the powder supply and remove finished parts as they accumulate. An interesting photo-sequence of the several steps in making a typical part is available in Bulletin 560. This and a new edition of "Fully Automatic Compression and Injection Molding" will be sent on request.



Stokes Model 700 injection molding machine of 4-ounce capacity at the Asheboro, N.C. plant of General Electric's Automatic Blanket & Fan Department. The machine is truly automatic in operation, producing any type of piece completely degated and ready for packing or assembly. One man can run a dozen or more such machines.



Stokes-Windsor RC-65
Extruder in operation at Battelle
Memorial Institute, Columbus, O.

Battelle Memorial Institute Using Versatile Stokes-Windsor Extruder

Research and development in the Rubber and Plastics Division of Battelle Memorial Institute, Columbus, Ohio, is concerned with almost all phases of the preparation and application of rubber and plastics. Plastics research, especially, calls for the compounding of many different materials. To accomplish this, it is necessary to have equipment capable of effectively mixing compounds varying in viscosity from thin liquids through tough rubbery or plastic masses.

The heavier compounds, of course, could be handled on 2-roll mills or in heavy-duty internal mixers, but only on a batch basis. Since continuous mixing is sometimes preferable, the Stokes-Windsor Twin-Screw extruder was obtained to fill this need.

While the studies in which this extruder is being used are too detailed for discussion here, it can be said that so far the uses have included the blending of polymers and the dispersion of master batches in polymers.

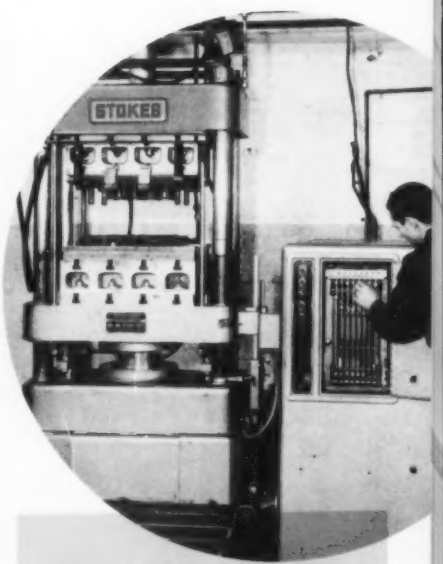
It is expected that the Stokes-Windsor extruder will also be used for extrusion per se. In some instances, it is necessary to extrude a relatively small amount of a finished profile. In this case, a general-purpose extruder is needed so that a wide variety of the plastics can be handled. The Stokes-Windsor is expected to permit extrusion of plastics varying from polyethylene through rigid vinyls and nylon and will be used for some pipe extrusions.

Stokes Straight Ram Molding Press Performs Like a "Wizard" at O. Z.

The O.Z. Electrical Manufacturing Company, Brooklyn, N.Y. makes a complete line of fittings, solderless connectors, cable terminators, junction boxes; in fact, just about every fitting required in distributing light and power conduit around industrial plants and office buildings.

An important facet of O.Z.'s production is the molding of plastic insulating bushings for all conduit sizes from ½ to 6 inches. These knurled bushings, some with internal and others with outside threads, are molded from phenolic pellets in semi-automatic straight ram compression presses. Parts are unscrewed from the mold after curing and flash removed in a final finishing operation.

Until the installation of the Stokes 100-ton Model 726 press, however, O.Z. experienced production problems in the molding of these bushings. On the machines used previously, pressures were uneven and during cycle time could not be accurately controlled; both important factors in producing bushings of uniform strength. Mr. Irving Seifer, O.Z. vice president and general manager, says, "Because of the even pressure and accurate curing cycle on this machine, we are able to produce fittings with a more uniform maximum strength. The rapid movement of the ram has also enabled us to increase our production approximately 10-15%." Needless to say, the performance of this Stokes press with its patented Bar Controller has endeared it to the hearts of the production men at O.Z. Manufacturing. Present plans call for adding more of these straight ram presses. Complete specifications of Stokes straight ram presses are available in Bulletin 520.



Stokes Model 726 at O.Z. Mfg. Co. The press has solved quality control problems and boosted production rates by 15%.

STOKES

F. J. STOKES MACHINE COMPANY
5534 TABOR ROAD, PHILADELPHIA 20, PA.

STOKES MAKES: High Vacuum Equipment, Vacuum Pumps and Gages / Industrial Tabletting, Powder Metal and Plastics Molding Presses / Pharmaceutical Equipment

PRINTED IN U.S.A.

Lightweight luggage, fabricated of vinyl-to-magnesium laminate, is durable and scuff resistant; even youngsters handle it easily

Here's How VINYL-TO-METAL LAMINATES are Made and Used

Photos on this page courtesy Shwayder Brothers, Inc.

Equipment used to laminate vinyl covering to magnesium base sheet prior to fabrication into luggage. Wooden rolls (left) over which vinyl travels are part of a tension system

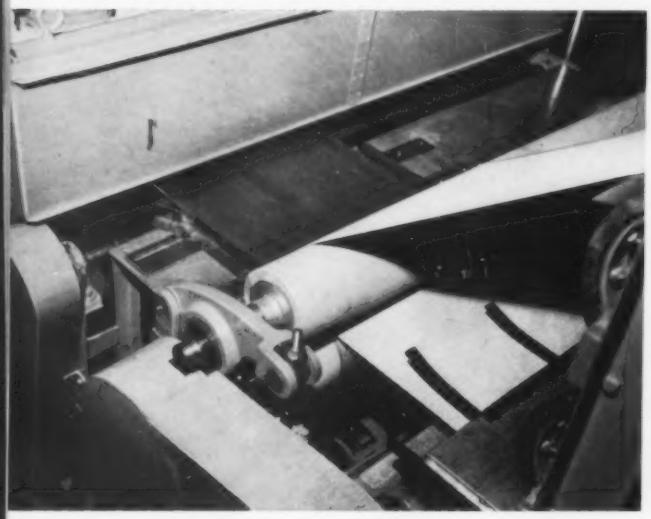
THE wonderful wedding of specially formulated elastomeric vinyl sheet—with its abrasion resistance, chemical resistance, weather resistance, and its beauty of color and embossed design—to metal—with its strength, rigidity, and formability—is resulting, literally, in a new industry and in a whole new approach to product design.

MODERN PLASTICS first reported on this development in May 1954 in an article concerned with the use of a vinyl-steel laminate in business machine housings. In the year since then 14 additional vinyl-to-metal laminators have moved into the business and more are coming in each month.

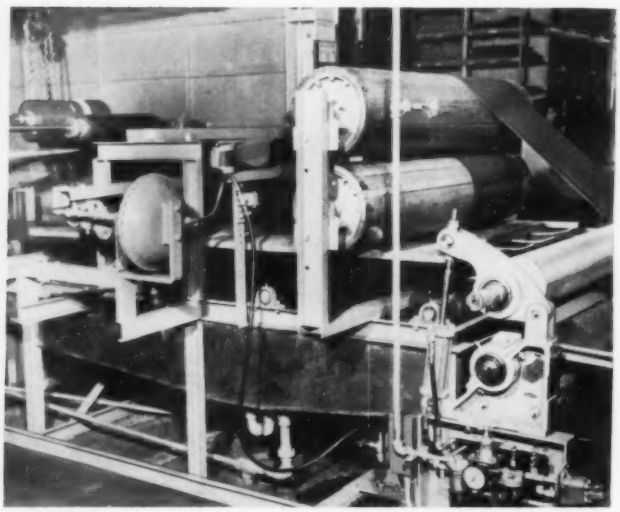
A variety of gages of special vinyl sheeting has been combined with steel, aluminum, magnesium, and copper to manufacture such products as duct work, luggage, instrument cases, panel boards, automotive interior parts, wainscoating, supermarket checkout counter tops, tele-

Magnesium sheets being fed into coater for application of adhesive

Adhesive from pressure tank is sprayed and rolled onto magnesium



Magnesium sheet (left) is leaving heating oven and vinyl sheet is coming off rollers at right; they are joined to produce laminate



Feed-off and guide rolls for vinyl sheet. Tension system (see photo on page 107) keeps vinyl aligned with magnesium sheet edge

vision cabinets, business machine housings and parts, wall surfacing, and containers.

As will be obvious from the listing later in this article of the companies involved, the laminators moving into the field are not traditional plastics entrepreneurs but are people with experience in metal or rubber, or are captive processors. As will be obvious from a discussion of the methods used, this is a business requiring considerable capital; an efficient and versatile small plant for this work costs at least $300,000.

Patents and Licenses

The patent situation on the process is still rather confused. Apparently there were over the past few years concurrent developments at Hood Rubber Co., Div. of The B. F. Goodrich Co. and in the development laboratories of the Naugatuck Chemical Div. of the United States Rubber Co. Press laminated material supplied by Hood Rubber was the first of record to be used. C. E. Kiernan of Naugatuck Chemical was successful in developing a high-speed continuous method of laminating. O'Sullivan Rubber Corp. was also a pioneer in laminating.

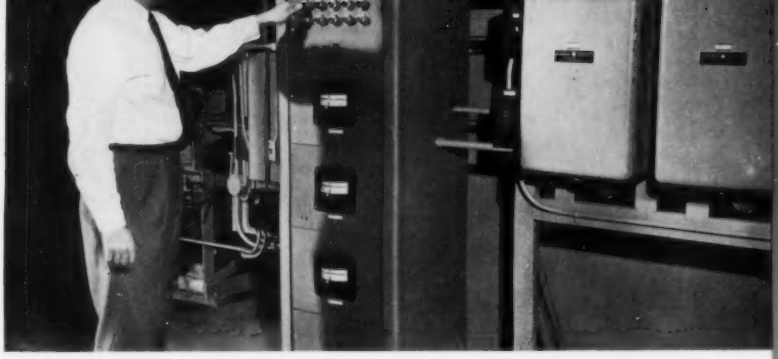
Basic adhesives research was performed by W. K. Fisher of Naugatuck Chemical.

Regardless of the patent picture, however, know-how of both processing and plant design is the key to success, and Naugatuck Chemical is disseminating this know-how through a licensing arrangement under the title "Marvibond Process."

Because of Naugatuck's intense interest in the whole matter, the company, under its licensed process, is setting up minimum standards for the film and sheeting to be used, as well as standards for the finished product. It is of paramount importance that proper bond strength be developed so that the laminate may be deep-drawn without fracture or loss of adhesion.

Photos on this and the facing page, courtesy Shwayder Brothers, Inc., show principal steps in laminating vinyl to magnesium sheets and fabricating the laminate into luggage with molded end pieces.

Not a typical installation, but an exceptionally efficient one is that of



Important phase in continuous production of vinyl-metal laminate is heat control in initial adhesive drying chambers and in the unit which heats the magnesium sheet to about 300° F.

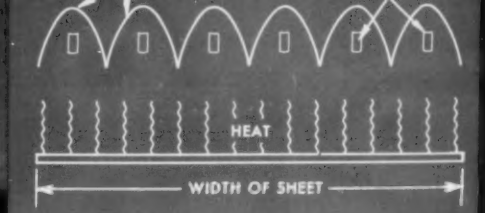
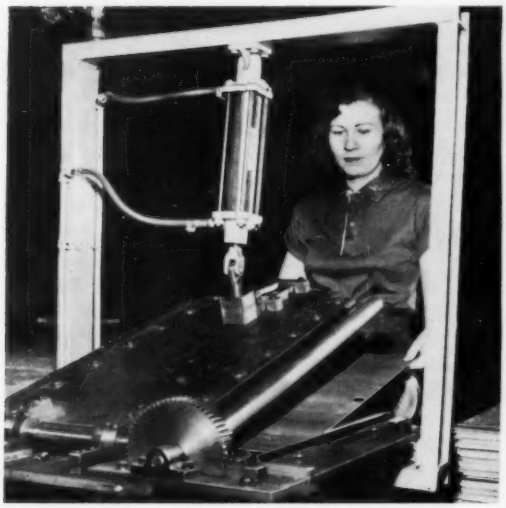
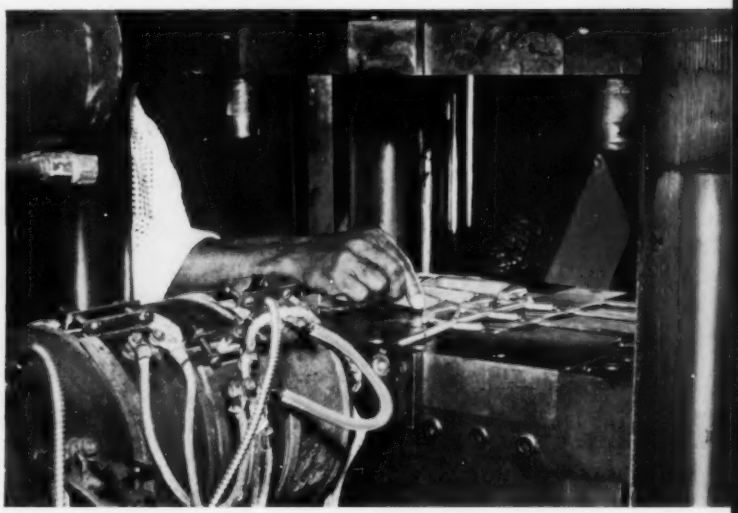


Diagram of device for sensing temperature of adhesive-coated sheet of magnesium. (See page 110 for a simple description of this equipment)



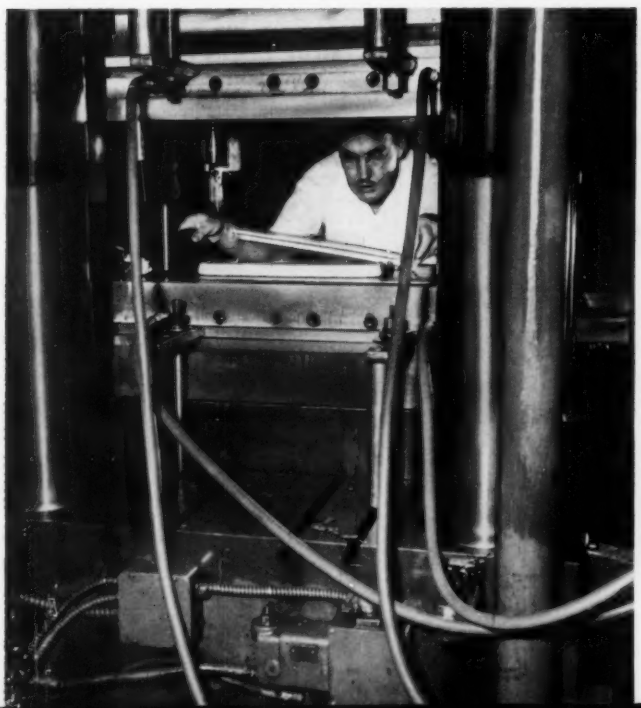
Bending machine forms laminate into half a luggage case



Injection molded vinyl handles, to be attached to case, are removed from mold

Molded ethyl cellulose end caps are removed from injection machine

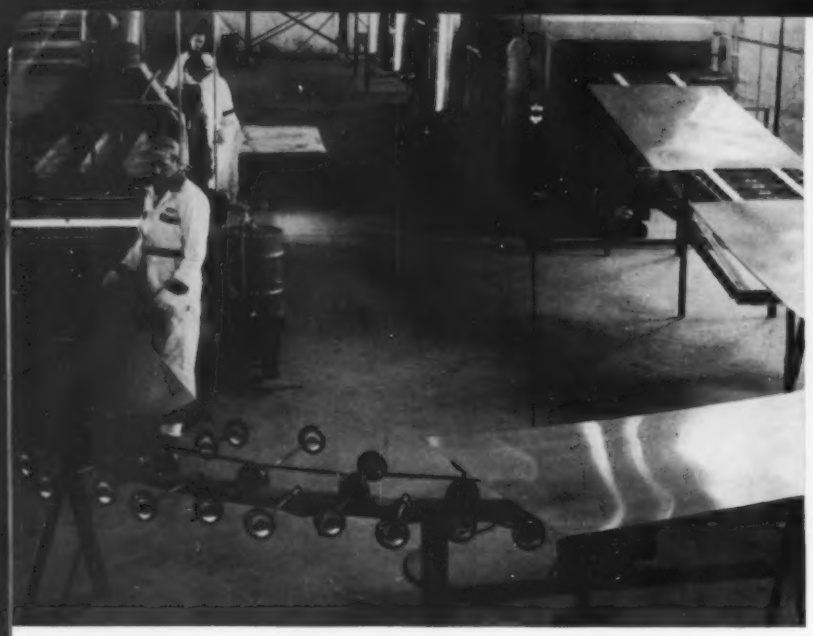
Half of case is assembled to molded ethyl cellulose end cap



ing mechanism into a "Wringmaster" laminating roll made by Rodney Hunt Machine Co., Orange, Mass. The vinyl sheet is in 300-yd. rolls

The end pieces of the new luggage are molded of ethyl cellulose in Shwayder's own injection plant and are so designed that the ends of the

the laminate will not support combustion, and is highly abrasion resistant, permanent in color and finish, and quite economical. It appears



Metal-treating tank tunnel (right) and continuous sheet laminator (left)

Treated metal sheets are fed into adhesive coater

Shwayder Brothers, Inc., Denver, Col., world's largest luggage manufacturer. Dow magnesium sheet is delivered already treated into the Shwayder plant. Embossed colored vinyl sheet is delivered in rolls with the pattern on the inside of the rolls. Shwayder specifies a high-molecular-weight plastisol or organosol coating on its vinyl sheet for greater pattern protection. The adhesive used is Kotal 330 made from a Naugatuck resin.

The machine that does the laminating is 80 ft. long and is a mass of temperature and pressure controls. Currently it is handling the metal in sheet form but with a flying shear and a straightener on the end it could easily be adapted to laminate from coiled metal. It is currently also handling magnesium 25⅜ in. wide by means of baffles; but it is designed to produce laminates up to 48 in. wide.

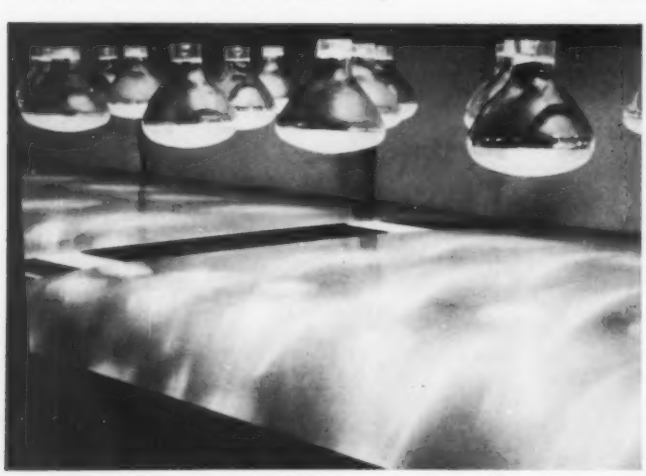
In the first step, the cleaned and treated magnesium sheet is automatically sprayed with adhesive in solvent solution from pressure tanks, the adhesive being then evenly spread by squeeze rolls. In one pass the adhesive-coated metal is heated by Chromalox heating elements to drive off the solvent. Then comes a second heating to bring the metal up to 300° F. preparatory to bonding.

Willard Axtell, chief engineer, and Charles E. Bell, electrical engineer of Shwayder, have developed a very simple device for sensing the temperature of the sheet without touching it. The device consists of a series of parabolic reflectors with thermocouples at their focal points. The heat from the adhesive-coated magnesium sheet is gathered by the parabolic reflectors and focused upon the thermocouples which in turn control the oven temperature.

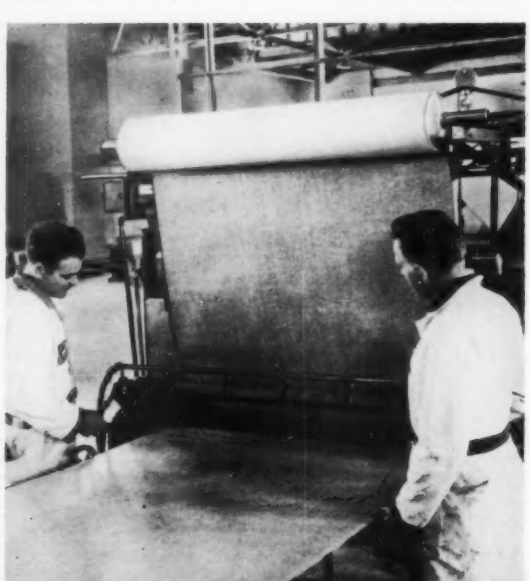
Actually, the total adhesive-applying process is divided into five zones for the exact control of heat. If the machine is producing 25⅜-in. material of 20 linear feet a minute, only three of these zones need be used; at 35 ft. four are needed; and for the full 48-in. width at top speed all five would be used.

The vinyl is fed cool from rolls through a rather intricate thread-

Adhesive is set on sheet with aid of heat lamps



Adhesive-coated sheet has vinyl skin when it emerges from roll laminator



ing mechanism into a "Wringmaster" laminating roll made by Rodney Hunt Machine Co., Orange, Mass. The vinyl sheet is in 300-yd. rolls slit to a width slightly under that of the metal; pressure during processing brings it to the same width in the finished laminate. A diaphragm-type control is used to produce perfect alignment. The vinyl passes over a tube with holes spaced 1/16 in. apart; when any hole is uncovered because of crooked feed, the machine automatically adjusts itself. Three variable speed drives are used to prevent friction wiggle; tension is approximately 10 lb./in. of width of the vinyl and depends upon the thickness of the sheet.

Immediately after the laminating process, the sheets are cut apart and fed into a cooling section where cold water is sprayed from below to cool the bottom of the laminate, and then through rubber rolls which squeeze off the water.

In the manufacture of Shwayder's new line of "Ultralite" magnesium-plastic luggage, the completed laminate sheets are formed into side components on single-purpose forming machines which roll rather than draw the laminate into the proper form. Other single-purpose machines punch the hardware holes.

Photos on this and the facing page, courtesy Clad-Rex Steel Co., show equipment and processes used by that company for laminating vinyl to various sheet metals.

The end pieces of the new luggage are molded of ethyl cellulose in Shwayder's own injection plant and are so designed that the ends of the vinyl-magnesium laminate panels fit into them with the use of a special adhesive produced by Minnesota Mining & Mfg. Co. for the job. Handles are of injection molded vinyl. Since the components of the assembly have all been pre-punched for holes which match up, the hardware is quickly riveted on; the lining is applied by self-tapping screws into an extruded magnesium frame.

Typical General-Purpose Plant

Possibly a more typical general-purpose vinyl-metal laminating plant is the one set up by Clad-Rex Steel Co., also in Denver. This company has had much experience in metal-treating, but spent fully 18 months in designing high-speed equipment for the application of adhesive and the handling of the laminating process.

Briefly, Clad-Rex cleans and abrades steel or aluminum sheets, applies adhesive, heats the sheets in an infra-red tunnel to accept the vinyl, applies the vinyl skin by pressure rollers, cools by water spray, then trims to size for shipping. Clad-Rex has a complete line of these laminate materials for the furniture and wall-surfacing industries and has developed a mastic for applying the sheets to plaster and other wall surfaces. The material lends itself well to forming inside and outside corners and coving for use on walls, and the company is seriously going after that market. Used on walls, the laminate will not support combustion, and is highly abrasion resistant, permanent in color and finish, and quite economical. It appears now that costs of fully applied laminates as wall surfacing can be brought to comparable installation costs of plastic or metal tile.

Other Production

The work being done by O'Sullivan Rubber Corp., Winchester, Va., was described in part in the April 1955 issue of MODERN PLASTICS Magazine, the product being a television cabinet. O'Sullivan calenders its own vinyl sheeting in a formulation especially designed for the purpose of lamination and embosses it. Sheet sizes vary, the biggest being 52 by 120 inches. Steel, magnesium, and aluminum are used.

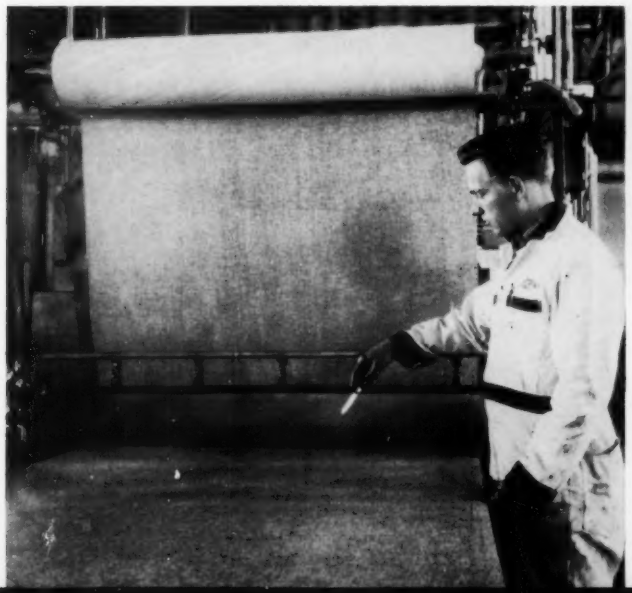
Met-L-Wood Corp., Chicago, Ill., is moving into the production of laminate sheets up to 48 by 144 inches. This company has experience in covering plywood with metal, so its move into the field of vinyl-metal laminates was logical.

Hood Rubber Co., Div. of B. F. Goodrich, Watertown, Mass., which created the first of these materials to be fabricated in production, is laminating vinyl to aluminum and steel in sheets up to 48 by 72 in. in size. Hood Rubber Co. calenders and embosses its vinyl to its own specifications.

Litho-strip, Div. of M. M. Young & Co., also of Chicago, is laminating vinyl to coiled strip steel and aluminum. Present facilities will provide a strip up to 16 in. wide, but a new

(*To page* 230)

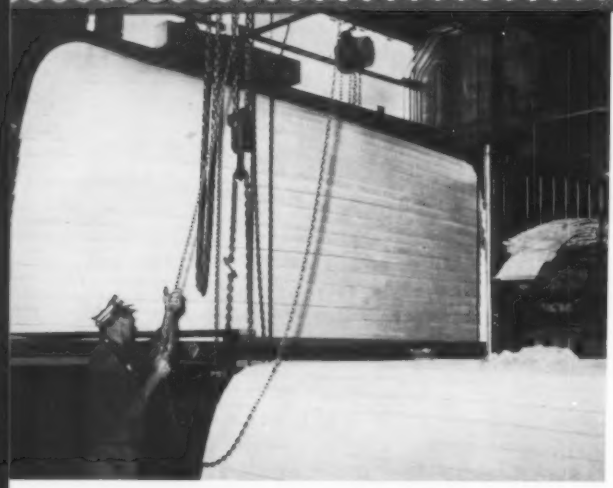
Knife is drawn across vinyl so sheets may be separated



Separated vinyl-metal laminate sheets are trimmed in shear

One-piece

Desirable marine features dictated choice of lap-strake design for new hull

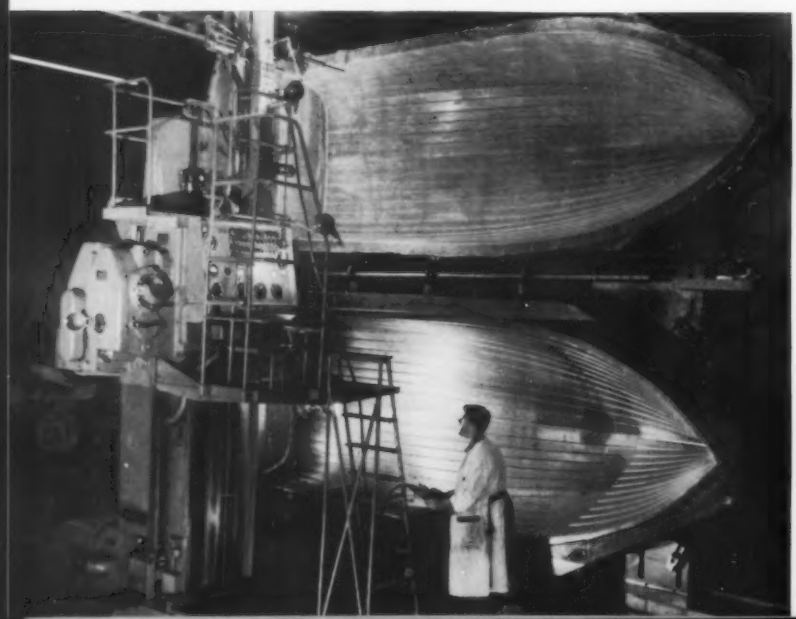


Lightweight, mar-resistant boat hulls are conveniently nested for shipment, 18 hulls to a stack, on special pallets. Two such pallets make a truckload

EVER since fibrous glass-reinforced polyesters were developed, with their corrosion resistance and inherent strength, the boat business has been a logical target for reinforced plastics. To this writer, whose organizations have specialized in molding reinforced plastics in matched metal dies, boat manufacture has been a challenge for years. Unfortunately, we had neither large enough equipment nor previous experience in dies this large, to prove that a large boat hull could be so made. Further, there did not exist, until late in 1953, a

* President, Molded Fiberglas Body Co.

Female boat hull pattern (at bottom in picture below), on which male mold will be cast, is produced from Keller model (at top); tracer is visible in top center of picture



Preform machine has 150-in. diameter table. To accommodate boat hull, screen is formed in "U" shape

Molded Boat Hull

by ROBERT S. MORRISON*

Keller duplicator large enough to make matched metal molds of such size.

In 1953 and 1954—the story is well-known—circumstances contributed to our obtaining plant equipment and experience on press molding of large reinforced parts in matched metal dies. An automotive manufacturer placed an order for all the body parts of a sports car to be molded of reinforced plastics in matched metal dies. A new plant was built, specialized big preform equipment was engineered, and very large presses were developed and installed. At the same time, R. H. Freitag Mfg. Co. purchased and installed the first 7-ft. by 16-ft. by 42-in. Keller duplicator ever built.

The underbody of the sports car (see MODERN PLASTICS, *31*, 115, Aug. 1954), 10 ft. long, 70 in. wide and 26 in. deep, was the largest press-molded piece ever produced up to that time.

Cars to Boats

With a cut-back in the sports car program, we were faced with the prospect of having a big and specialized preform machine and a big press, representing an investment of at least $125,000, in use only two or three days a month. But the sports car job had taught us much about big dies, and the results in quality of production were good enough to indicate that a) matched metal dies could produce a boat hull and b) the equipment set up to produce the sports car parts could do this new job.

With the object of tackling the proposition on a proprietary basis to hit the 1955 sports boat market, we ordered last October 15th from Freitag the dies to produce a 15-ft. lap-strake boat hull, our intention being to sell that hull to existing boat builders. The dies represented an investment of $65,000.

The lap-strake design was chosen because of its desirable marine features. In a molded hull, it would have no seams to open up under any conditions.

To start the project, the design of a wood lap-strake hull was modified so that it could be properly molded of fibrous glass-reinforced plastics. With this hull mounted on a large plate, parting line pinch-offs were built up, and every point was carefully checked for symmetry. Corrections were made and epoxy resin and fibrous glass cloth were laid up to make a female Keller model. This model was supported by a framework made of fibrous glass-reinforced plastic tubes to insure dimensional stability.

These two models then were used to make patterns for Meehanite castings for the hull, which were delivered to the toolmaker to be used as Keller models. The female glass cloth and epoxy Keller model was also used last November to make five hulls of hand lay-up glass cloth and polyester resin for water test purposes. These tests were carried on by boat builders during the

Final glass overlay mat is placed on top of resin-covered preform

Cured preform is removed from preform machine; it will next be placed, in one piece, on male die preparatory to molding of the boat hull

After preform has been laid on male die, pigmented resin is poured over it and carefully spread for good distribution

At end of 7-min. cycle, press is opened, and the part remains in the female mold. The steam-heated dies are Meehanite coastings insulated by cloth-covered fibrous glass insulation

Molded hull is removed from press. The transom is molded-in solid, and the part requires careful jockeying by the press operators in order to clear both dies

All photos with this article courtesy Molded Fiberglas Body Co.

As the final step in production of reinforced plastics boat hull, minor imperfections are filled and sanded, and flash is removed from edge of molded part by finishers

winter in Florida and the test results were excellent.

The boat dies were delivered from Freitag on March 23rd and 24th and installed in the large press. In the meantime, a preform screen had been built to mount on the largest preform machine we had. This screen has the same area dimensions as the boat hull and the transom and prow were exact duplicates of the same parts of boat hull.

On March 25th and 26th, ten boat hulls were made and delivered to Barbour Boats, Inc., New Bern, N.C.; Cadillac Marine and Boat Co., Cadillac, Mich.; Thompson Bros. Boat Mfg. Co., Peshtigo, Wis.; and Wagemaker Co., Grand Rapids, Mich. A later one was sent via air freight to Bryant's Marina at Seattle, Wash. However, the dies were not quite right, which was expected, and these first hulls were not of the proper thickness at all points. After these first hulls were made, a crew of "die barbers" worked for over two weeks bringing the dies to proper material thickness.

During the week of April 11th, steady production on this boat hull was started. The production rate ran from 10 to 15 hulls per eight hours in the first few weeks but it advanced to 20 to 25 hulls per eight hours thereafter.

Preform Weight

The preform weighs 7½ oz. per sq. foot. One layer of 10-mil Silane-treated veil mat is used over the preform to provide a white surface and protection against moisture. A pigmented, filled semi-flexible resin mix is used. This resin mix has low shrink, excellent impact resistance, and exceptionally high flexural modulus, flexural strength, tensile strength, and water resistance.

When the hull is removed from the press, the flash line is sanded, minor imperfections are corrected, and dirt marks caused in handling are removed. Boat hulls are stacked 18 high on pallets, two pallets to a trailer load.

Three of the boat builders listed above pick up hulls in their own trailers while the more distant ones use commercial motor freight.

The advantage of shipping nested hulls is very great. In some areas, the freight on a finished boat will run as high as $150. We had orders for boat hulls from Alaska, Hawaii, Mexico, Canada, Panama, and the Caribbean. By nesting hulls, the freight rate is reduced considerably. By being able to ship hulls over such a wide area in competition with local boat builders, the investment in equipment and dies can be spread over a large enough production of boat hulls to make the die amortization and overhead cost quite low per boat hull.

Mass Production

We expect to produce 5000 hulls per year in this first set of dies and have a second set of dies under construction for a lap-strake hull 12 ft. 9 in. long. We are also considering a smaller hull about 11 ft. 6 in. long and a bigger hull between 17 and 18 ft. long. This larger hull will require a new press, a new preform machine, and a new building. Not

(*To page* 232)

Auto Compass Redesigned in Plastics

Design flexibility, color, non-magnetic characteristics, and dimensional stability of materials were all reasons for a switch

Easily attached to windshield frame of car, modern auto compass has molded styrene housing, transparent acrylic inner bowl that encloses the magnetic parts, and a nylon adjustment screw which controls the position of the compensating magnets located in the base of the unit

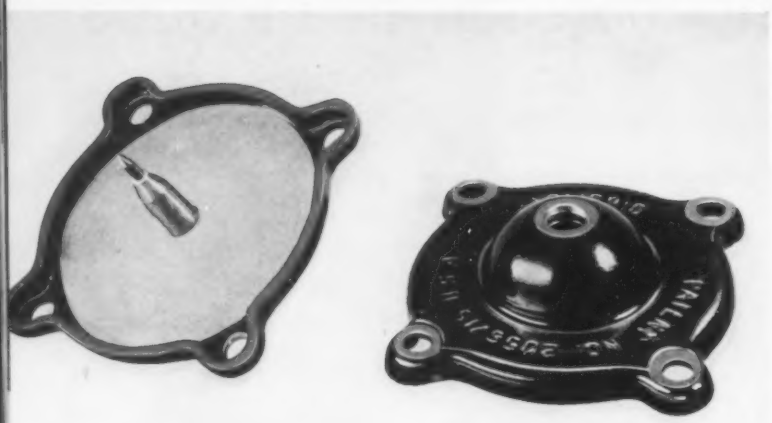
FAVORED materials for automobile compasses are plastics which permit the manufacture of housings and related components that combine great latitude of design, inherent color, non-magnetic characteristics, dimensional stability, and ease of assembly. With these advantages, it is possible to produce the instruments at relatively low cost for mass-market distribution.

The experience of one manufacturer—Dinsmore Instrument Co., Flint, Mich.—which was the first organization to turn out a production model automobile compass nearly 30 years ago, provides a specific illustration of why plastics are the logical materials for this type of instrument. This company's present compass is constructed almost entirely of molded plastic parts, including styrene, acrylic, and nylon; the company's first auto compass, built in 1927, consisted basically of two metal plates acting as cylinder ends over two serrated lead gaskets and a glass cylinder. The compass dial itself was suspended inside the cylinder on a brass and steel pivot, and the cylinder was filled with a fluid to keep the dial steady.

Parts Eliminated

The addition of plastics has not only eliminated many parts and operations, but has also enabled the company to remain competitive over the years. At the time of introduction, the metal and glass compasses were completely hand made. Working on this basis, it was possible to adjust each instrument carefully and make it as nearly leakproof as that type of assembly would permit. However, as sales mounted, it became apparent to the manufacturer that this design left much to be desired. The mechanical seals were not perfect and rapid changes of temperature often caused them to break. Once this occurred, the compass ceased to operate properly. Furthermore, its appearance was considerably marred by a line of fluid visible through the cylinder.

When the original compass was introduced, the vertical, straight windshield was the prevailing type used by auto manufacturers. The trend toward slanted windshields, started in the early 1930's, permitted more sunlight to strike the dash panel directly—particularly the compass—and the temperature range encountered became much wider. As the problem grew more acute, Dinsmore undertook a program of redesign to give the compasses greater resistance to temperature changes. In 1940, the company introduced a hermetically



Top and bottom metal plates that were required in making an earlier type of automotive compass. Various operations involved in producing these metal parts included stamping, trimming, machining, and painting

Assembly of the early type metal-style compass necessitated the use of numerous screws and posts—all of which took considerable time and labor to fasten

sealed, self-contained plastic unit. At the same time, the exterior of the instrument was redesigned into an attractive teardrop shape. The redesign enabled the manufacturer to set up on more of a mass production basis, as compared to the original "batch" type operation.

As windshield slants became more pronounced, Dinsmore found it necessary to increase the temperature resistance of the compass material progressively. Some of the earlier injection molding materials used by the company exhibited extensive cold flow; specifications or materials were changed frequently to obtain the desired properties.

At present, styrene, acrylic, and nylon are the plastics used in the Dinsmore auto compass. The top and bottom housing components, between which the transparent bowl with its compass dial are enclosed, are molded of styrene in either black or dark grey. The bowl-like cup and its cap shaped cover, which correspond to the glass cylinder used in the original compass, are of acrylic, as is the tiny plug which seals the opening in the top of the cap. Nylon is used for two small parts—a wedge-shaped shim which permits adjustment of the position of the metal bracket used to mount the compass in the car, and a threaded shaft and adjustment knob controlling the position of the two small magnets which compensate the instrument for accurate readings.

Injection Molded

All of the plastic parts are produced on 8-oz. injection machines. A two-cavity combination mold is used for the styrene housing components, and two four-cavity molds are employed for the acrylic parts—one for the bowls, the other for the domed covers. The nylon worm, which when rotated engages two small brass gears, raising or lowering the adjustment magnets, is produced in a single cavity which runs as part of a larger unrelated die. These parts are produced by a custom molder and shipped to Dinsmore for final assembly.

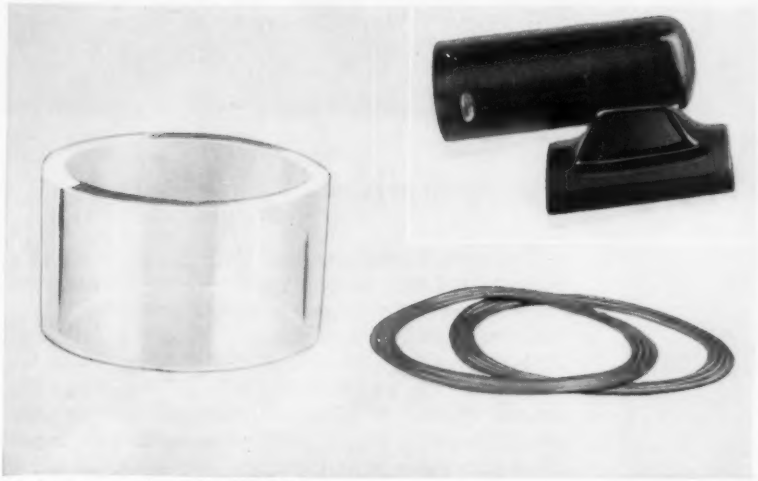
In the assembly operation, the magnetic working parts of the compass are first assembled in the bowl. This part is molded with an internal stem having a small recess at the top on which the compass dial pivots freely. After the magnetic parts have been assembled, the acrylic cover is cemented in position. When the joint has set, the bowl is filled with damping fluid through a small opening at the center of the cap, which is then plugged with the tiny tapered acrylic insert. At this stage of the assembly, it will withstand more than 150 lb. of internal pressure, making it virtually impossible for fluid to escape.

The bowl is then placed between the upper and lower sections of the styrene housing and these parts are joined by means of two thread cutting screws passing upward through cored openings in the base section. Included in the assembly is a wire clip which holds a bulb socket in position. The housing is so designed that this socket, with a 6-v. bulb, may be inserted in a molded recess at the back, providing illumination for the compass at night. The pressure of the spring retains the socket in position, permitting easy removal.

The two small magnets are carried in a small brass subassembly containing the brass gears and the threaded nylon shaft whose rotation controls the position of the magnets. This unit is riveted to the underside of the case so that it may be rotated to adjust the compass after it has been installed in the car. A metal cover, finished to match the color of the plastic case, conceals the adjustment assembly. Three prongs on the base of the cover snap into cored openings at the bottom of the housing to lock it in place.

CREDITS: Parts for Dinsmore compass molded by United Plastic Co., Vassar, Mich., using Koppers No. 81 styrene, Du Pont Lucite No. 140 acrylic, and Du Pont Zytel nylon.

laborious assembly, poor seals

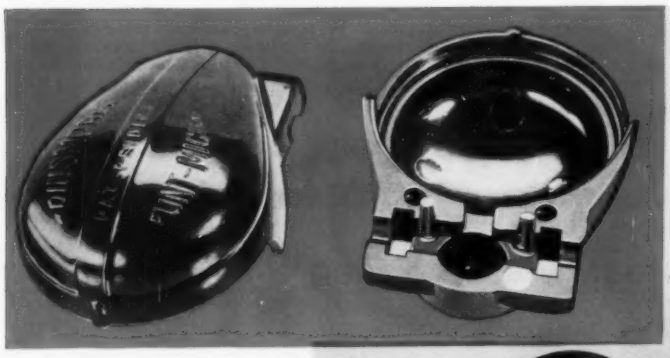


All photos courtesy Dinsmore Instrument Co.

Glass cylinder and two serrated lead gaskets were used in early type compass. Leakage of damping fluid was frequent, particularly when compass was exposed to sunlight. Light housing containing bulb assembly (inset) was attached to back of cylindrical housing

Style-wise, metal compass presented a cluttered appearance; use of plastics made possible modern, streamlined design (see below)

Plastics Parts—no machining, simple assembly, good seals



Plastics components used in new compass: Two parts at left in picture are upper and lower halves of styrene case (see close-up above); acrylic bowl in foreground fits into circular front chamber of case and holds the damping fluid; bowl cover (right foreground) is sealed by acrylic plug next to it; nylon wedge in foreground is used as shim for attachment. Use of plastics parts has reduced assembly time and overcome other problems associated with earlier unit

PLASTICS

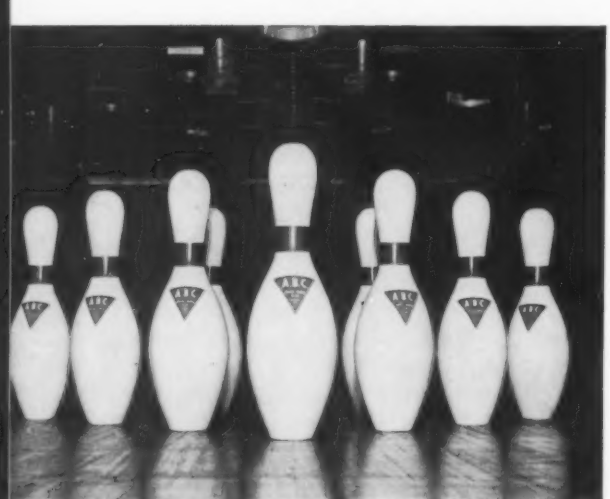
Multi-Purpose Baby Bath

A portable bathtub for babies, which can double as a versatile dishpan, laundry basket, or jumbo basin for various household chores, is injection molded in one piece of flexible polyethylene. Although it measures 23¼ in. long, 16 in. wide, and 5¾ in. deep, the lightweight bathtub, known as Baby Bath, weighs only 1¾ pounds. The tub is molded with a rolled rim which not only serves as a grip to make it easier to carry when filled with water or wet laundry, but also lends added rigidity to the walls of the tub. Unlike the conventional metal tub, the polyethylene product has no sharp edges on which the baby can cut itself. The flexible tub also will not scratch porcelain or wood surfaces and is pleasant to the baby's touch. In addition, it will not stain or corrode and is easily cleaned with hot soapy water. Tubs are presently available in pastel colors—blue, pink, white, and yellow.

The baby bathtub is injection molded, using a single cavity mold.

CREDITS: Manufactured by Beacon Plastics Corp., 82 Needham St., Newton Highlands 61, Mass. Polyethylene supplied by Bakelite Co., Div. of Union Carbide and Carbon Corp., New York, N. Y.

Hollow Core Fibrous Glass Bowling Pin



Most recent application of reinforced plastics in the sports field is a bowling pin of extreme durability. In fact, the manufacturer claims that one set of the plastics pins will give longer service than two or more sets of conventional maple pins. In addition, the molded resin-glass pins are fire- and waterproof and highly resistant to chipping, cracking, and splintering. They do not require frequent refinishing operations as do their wooden counterparts and they can be safely cleaned with ordinary detergents. Each pin is molded to close tolerances to keep weight and size uniform.

The pins are injection molded with a hollow air-sealed central core that gives them the resiliency necessary for proper bounce when struck with the bowling ball. The walls of the reinforced plastics outer shell are ¾ in. thick.

CREDITS: Molded by American Bowling Corp., 2530 So. La Brea Ave., Los Angeles 16, Calif. Fibrous glass composition supplied by Koppers Co., Inc., Pittsburgh, Pa.

PRODUCTS

Counter-Balanced Hanger

Any convenient wall molding or ledge serves as a hanging place for Kantoo, a new type of molded styrene wall hanger that does not need nails, screws, or other mechanical fastening devices. One end of the styrene hanger is simply rested on the edge of the molding or ledge; the loop of an extruded acetate strap which is supplied with the hanger is then slipped over the other end. When flower pots, pictures, or similar items are hung on a brass hook suspended from a hole at the bottom of the strap, the styrene piece balances on the edge of the molding so that the piece cannot fall as long as weight is applied to the strap. A rubber pad cemented to the end of the Kantoo that rests on the molding prevents the piece from sliding and a molded-in rib on the other end holds the strap in place.

The wall hanger is injection molded in two halves that are then cemented together to form the complete part. Holes to accommodate the brass hooks are punched into the acetate strap after it has been extruded.

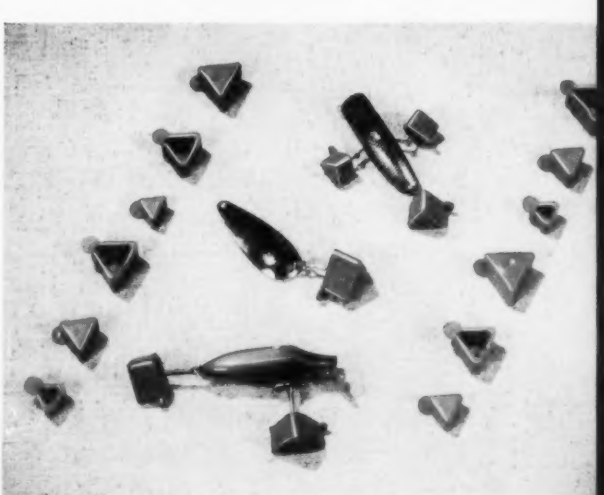
CREDITS: Manufactured by Lakewood Manufacturing Co., Box 24, Lakewood, Pa. Styrene supplied by American Plastics Co., New York, N. Y. Cellulose acetate supplied by Eastman Chemical Products, Inc., Kingsport, Tenn.

Flexible Protector For Fishing Hooks

Hook protectors molded of vinyl are so effective that fishermen can now carry treble (three-prong) fishing hooks even in their pockets without danger of snagging their clothing. The triangular-shaped flexible protectors, known as Bate-Mate, can be easily snapped over the hooks so that their sharp barbs are completely covered. A molded-in tab on the side of the guard facilitates removal. The tab is simply pulled back until the hooks snap out from under the retaining rim that runs around the top of the protector. When used in a tackle box or other container, Bate-Mate eliminates tangling and snarling of loose hooks and lures. Bate-Mate protectors are available in red and yellow and in six sizes to accommodate No. 1, 2, 4, 6, 8, and 10 hooks.

The hook protectors are produced on a 6-oz. injection molding machine using a 12-cavity mold.

CREDITS: Manufactured by Gladen Enterprises, Inc., Bay City, Mich. Vinyl supplied by B. F. Goodrich Chemical Co., Cleveland, Ohio.



Air Conditioner Cabinet Front
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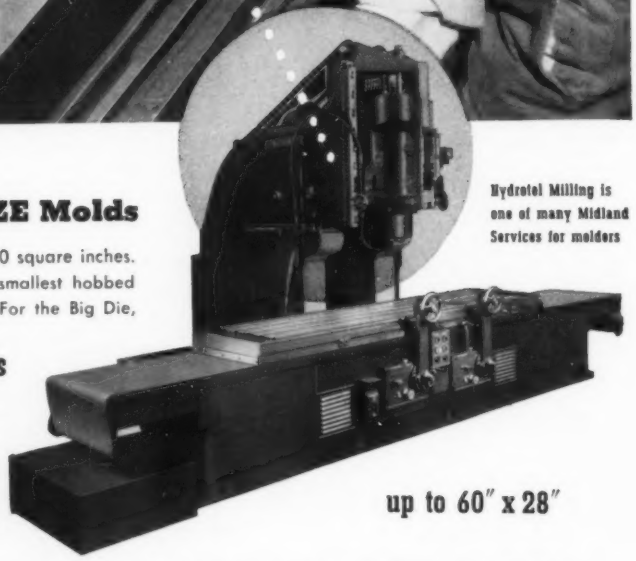

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Engineering Mold Design†

How good part drawings can help the mold designer; and how good mold designer's drawings can help the mold maker

by WAYNE I. PRIBBLE‡

GOOD plastics mold engineering should begin with good part drawings. Otherwise there may be troubles all along the line—troubles that could be avoided in large measure if the part drawings were executed with the problems of the mold designer in mind and if the problems of the mold maker were given due consideration when the mold designer produced his finished drawings. The best design in the world is worthless unless the draw-

*Reg. U. S. Pat. Off.
†Adapted from a paper presented at the 11th Annual Technical Conference of The Society of Plastics Engineers, Inc.
‡President, Pribble Plastics Products, Inc., New Haven, Indiana.

Fig. 1A—Molded cabinet based on design below

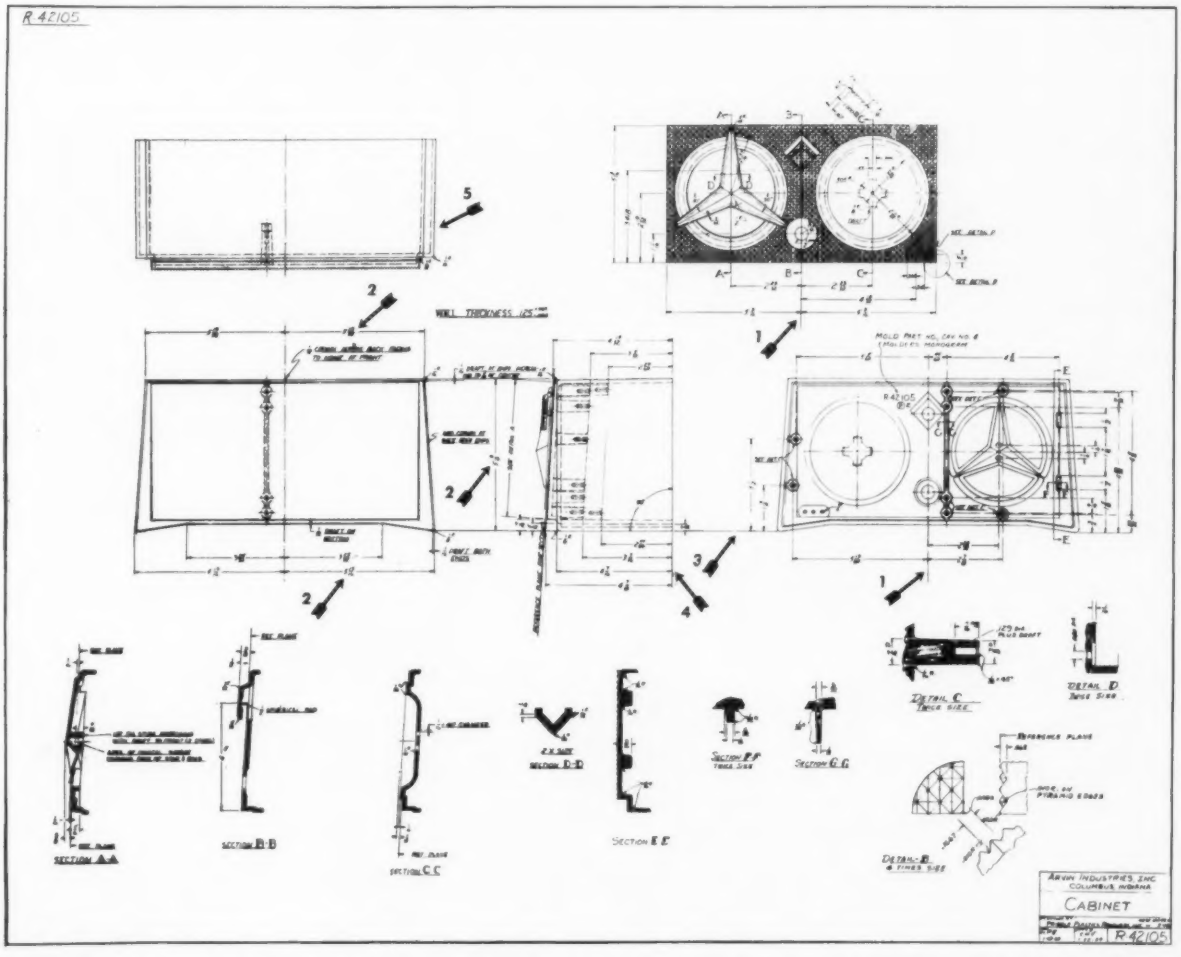


Fig. 1B—Drawing for cabinet above; numbered arrows, discussed on p. 123, point to features appreciated by the mold designer

In Fig. 1A, all the knockout pin

Starting with Fig. 2, the rest of

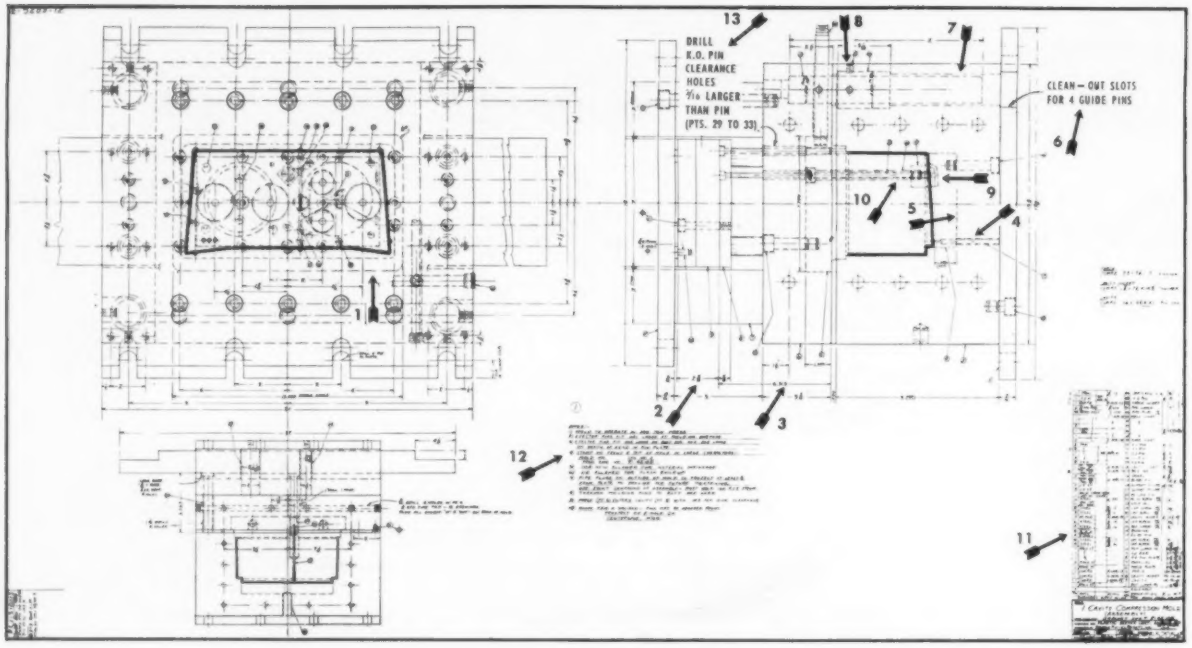
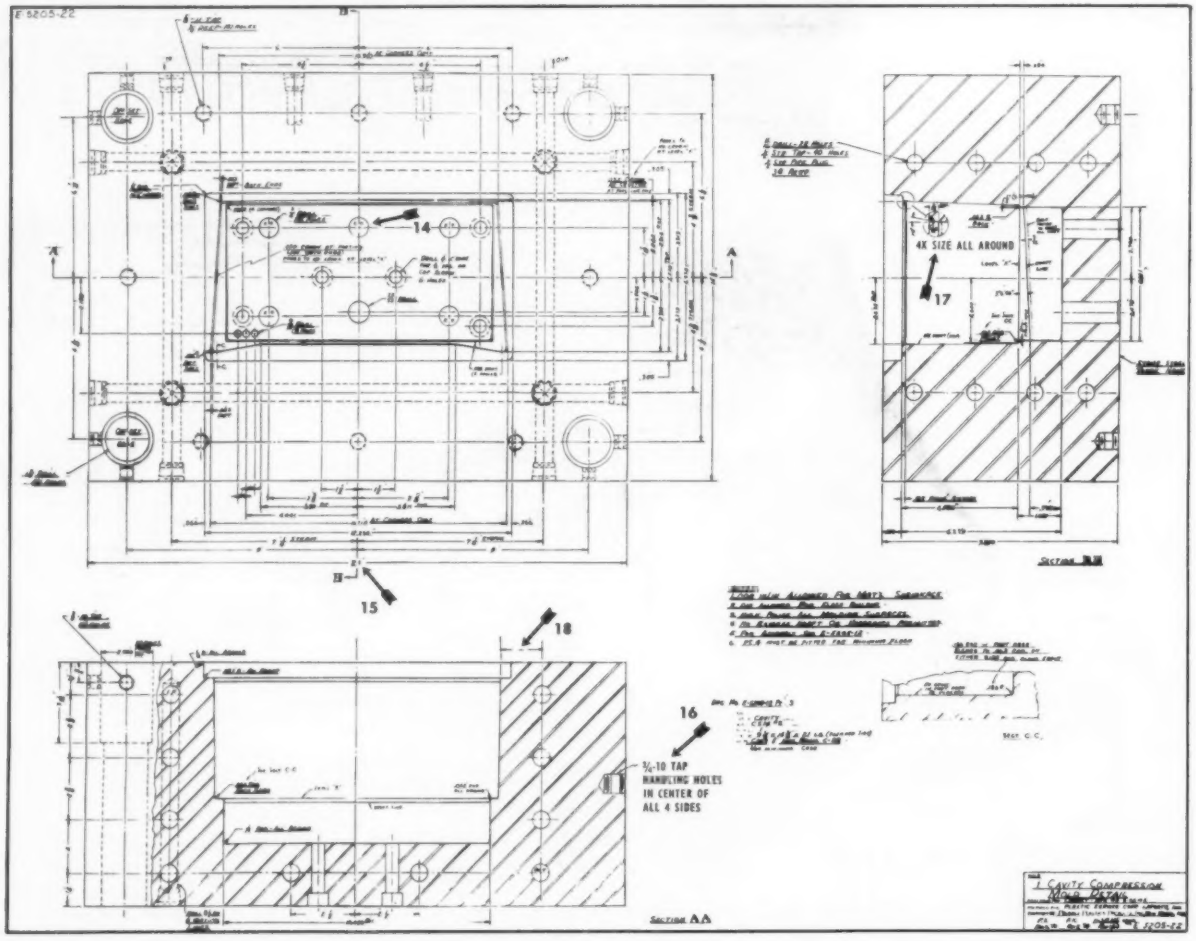


Fig. 2—Mold designer's drawing of complete single-cavity, semi-positive compression mold for production of radio cabinet shown on p. 121

Fig. 3—Drawing of cavity detail of mold shown above; again, numbered arrows indicate points not to be overlooked in preparing drawings



world is worthless unless the drawings are legible, easily understood, concise, and accurately done.

Example

To illustrate these important factors, a radio cabinet mold has been selected as an example and will be followed through from parts design drawings to mold design drawings in order to point out a number of procedures that will result in the greatest economies for all concerned.

After the parts drawings are received by the mold designer, and before the mold drawings are started, the mold designer must determine certain facts,[1] including: number of cavities; type of mold; bulk factor calculations; press requirements; and shrinkage factor.

A photograph of the front and rear of a radio cabinet example, as designed by Arvin Industries, Columbus, Ind., is shown in Fig. 1A. Plastics Service Corp., LaPorte, Ind., was the successful bidder on the molding job. Pribble Plastics Products, Inc., New Haven, Ind., designed the mold, and Ostrom Tool Co., Chicago, Ill., built the mold. After the job was completed, Arvin engineers advised that, from the dimensional standpoint, this was one of the best cabinets they ever had on their line.

[1]For other preliminary information and procedures see "Plastics Molding Engineering" (Chapter 6), by J. H. Dubois and W. I. Pribble.

In Fig. 1A, all the knockout pin marks can be seen in the bottom. There are no pick-up marks on the inside of the cabinet. The mold was designed so that the part would stay on the force . . . and it did.

Parts Drawing

Figure 1B is a drawing of the cabinet as received from Arvin. Several points which were of considerable help in designing the mold, indicated by numbered arrows for purposes of this discussion, follow:

1) Dimensions are given about a center line of the part, in this case, the center of the cabinet.

2) Dimensions are given at the open end of the cabinet. This leaves no doubt in the designer's mind whether to draft large or small.

3) All height dimensions are given from a base line. This requires only one dimension to locate the center of the mold when lay-out is started.

4) All depth dimensions are given from a base line which, in this case, is the parting line of the mold.

5) This might be considered as only a picture of the top of the cabinet, but one picture is worth 1000 notes to the mold designer.

This excellent drawing was prepared, in its entirety, in such a fashion as to leave no doubt in the mold designer's mind about what the parts designer wants.

Starting with Fig. 2, the rest of the illustrations with this article are greatly reduced reproductions of the drawings prepared by the mold designer for the guidance of the mold maker. Again, points of importance have been indicated by numbered arrows; where clarification is necessary, certain information which was hand-lettered on the original large drawings has been set in type.

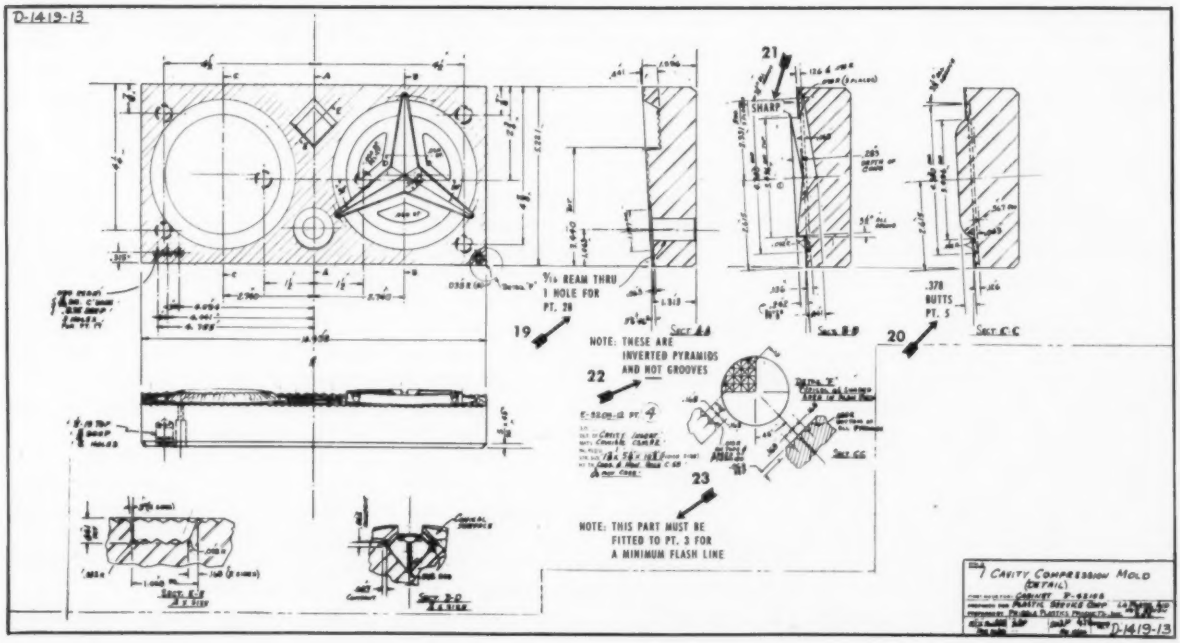
The mold to be produced (Fig. 2) is a single cavity compression mold of the semi-positive type, so called because it has a small entering section which produces vertical flash which can be sanded off. Specifications available to mold designer included: clamp slot center distances; knockout bar length; daylight and travel of press; and type of material and shrinkage.

The numbers in the following paragraphs link directly to the arrow numbers in the drawings and the text indicates how the mold designer can contribute to the successful operation of the finished mold.

Thus, as in Fig. 2, the plan view of the radio cabinet was first laid out and the part outline was shaded (1) so that it stands out. All mold inserts are shown in the plan view, as are all the knockout pins. At this stage, the designer should plan the steam lines in the force so knockout pins and screws can be located.

2) Knockout bar thickness should

Fig. 4—Detail of cavity insert for radio cabinet mold; as in other drawings, numbered arrows call attention to points discussed in text



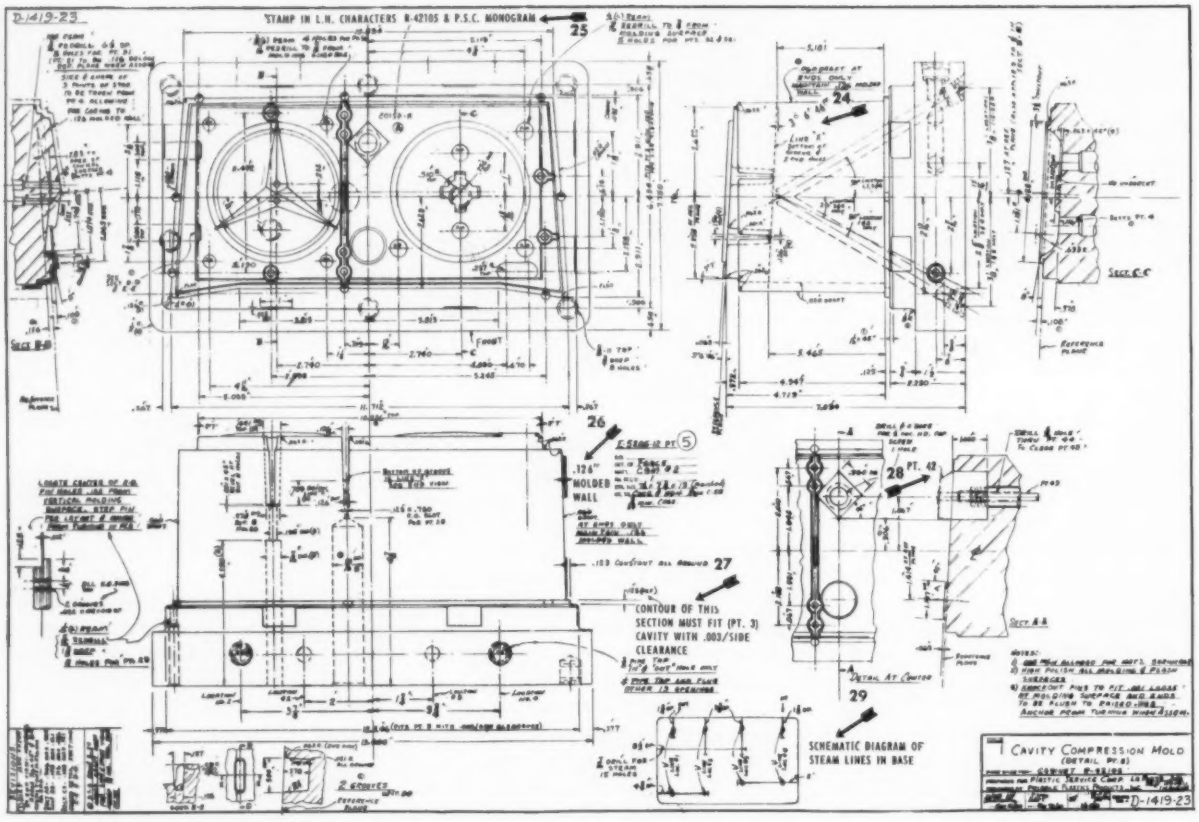


Fig. 5—Mold designer's detailed drawing of the complete force plug for the radio cabinet; arrows point to helpful notes to mold maker

be adequate to resist the enormous bending moment caused by using outside push rods. Thickness is much more important than width. The strength increases as the square of the thickness increases; doubling the thickness quadruples the resistance to bending.

3) Critical assembly dimensions were shown in decimals. The dimension itself is not important but, if any other dimension varies, compensating changes must be made in assembly dimensions.

4) An insert from the face of the cabinet goes through both cavity sections so the pin can be replaced by simply pushing it out and inserting another without doing more than removing the clamp plate.

5) The large cavity insert was designed to be inserted from the top of the cavity to obtain a more perfect match line. For this reason, no flash should be on the molded part at this point.

6) Provision of clean-out slots for the guide pin holes is like buying insurance; they may never be needed but they are nice to have if they are. Many molds have been wrecked because of plugged guide pin holes.

7) Guide pins are longer than the force so the pins enter ahead of the force when the mold closes.

8) Set screws on the guide pins and bushings keep them from pulling out. The mold designer doesn't know how good a press fit the mold maker will get and it doesn't pay to take chances.

9) A knockout pin at the lowest point in the cavity was included because this could be a potential trouble spot from trapped gas.

10) The mold designer wanted a small insert in the force, but there was no room for a screw hold and knockout pin. So the rule was violated which says "keep knockout pins away from screw holes" and the knockout pin was run *through* a screw. Deviation from accepted practice, when necessary, can be permitted when experience gives the green light.

11) A complete material list with stock sizes and type of material saves searching all over the drawing when the mold maker starts to order material.

12) Adequate notes for assembly, polish, mold stamping, and shrinkage help explain what is wanted in the final mold.

13) Adequate clearance holes for knockout pins insures that flash will not build up here.

Cavity Detail, Cavity Insert

Figure 3, the detail of the cavity, serves to illustrate the following five important points:

14) Holes are included so that cavity insert can be easily removed.

15) A liberal use of add-up dimensions will help the mold maker.

16) Handling holes make it possible for mold maker and set-up man to handle the mold with a crane.

17) Auxiliary sections should be included in the drawings wherever needed. It is a safe bet that if the part drawing has a section, the mold detail needs one.

18) Steam lines should have plenty of room; keeping them well away from the molding surface will avoid hot spots that cause flow lines. A little extra steel allowance here is good insurance.

In detailing a cavity insert such

as that in Fig. 4 the mold designer

24) Calculation of the angle in-

30) Rough machine dimensions

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as that in Fig. 4, the mold designer should note the following:

19) The part that fits each hole should be clearly indicated so the mold maker can cross-reference his own work to correct errors before it is too late.

20) If the height is important, the mold maker should be told why. The notation "butts part 5" tells him that if he alters one part he will have to compensate in the other.

21) On sharp corners where cut-off must be maintained, a warning note should be included. This assures that the mold maker will not break the corner and cause heavy flash line.

22) If there is a possibility of misinterpretation of dimensions, include a special note. The section indicated by arrow 22 had originally been drawn as grooves. For the mold maker to make the same mistake would be much harder to correct.

23) Where special fits are required, the information should be noted right on the drawing.

Force Plug

Figure 5, a detail of the complete force plug for the radio cabinet, illustrates the points indicated.

24) Calculation of the angle involved added drafting time but it could well save even more time for the mold maker, and total time is of the essence.

25) The part number, molder's monogram, and cavity number should be included in the drawings. If forgotten, a sloppy job of putting them in will be necessary.

26) The drawings should tell the mold maker how thick a wall section is allowed. This will help him to meet the part drawing tolerance—0.125, plus 0.007, minus 0.003, in the case of the radio cabinet used here.

27) Entering sections are critical. The mold designer should be sure to cover this with a special note.

28) When necessary to clarify dimensioning, assembled parts should be shown in phantom lines.

29) All possible detail should be given for steam line layout. Dimensions and notes are sometimes not as clear as a simple schematic diagram.

Inserts, Knockout Pins

Figure 6, which details force and cavity inserts as well as knockout pin assemblies, is used to bring out the following points:

30) Rough machine dimensions should be given where the mold designer is not sure how long a part will be when finished.

31) Notes as to how much allowance is made will tell the mold maker whether his assembly is right. A little time taken here will make doubly sure that he understands what is wanted.

32) Cross-reference to other drawings makes for rapid reference.

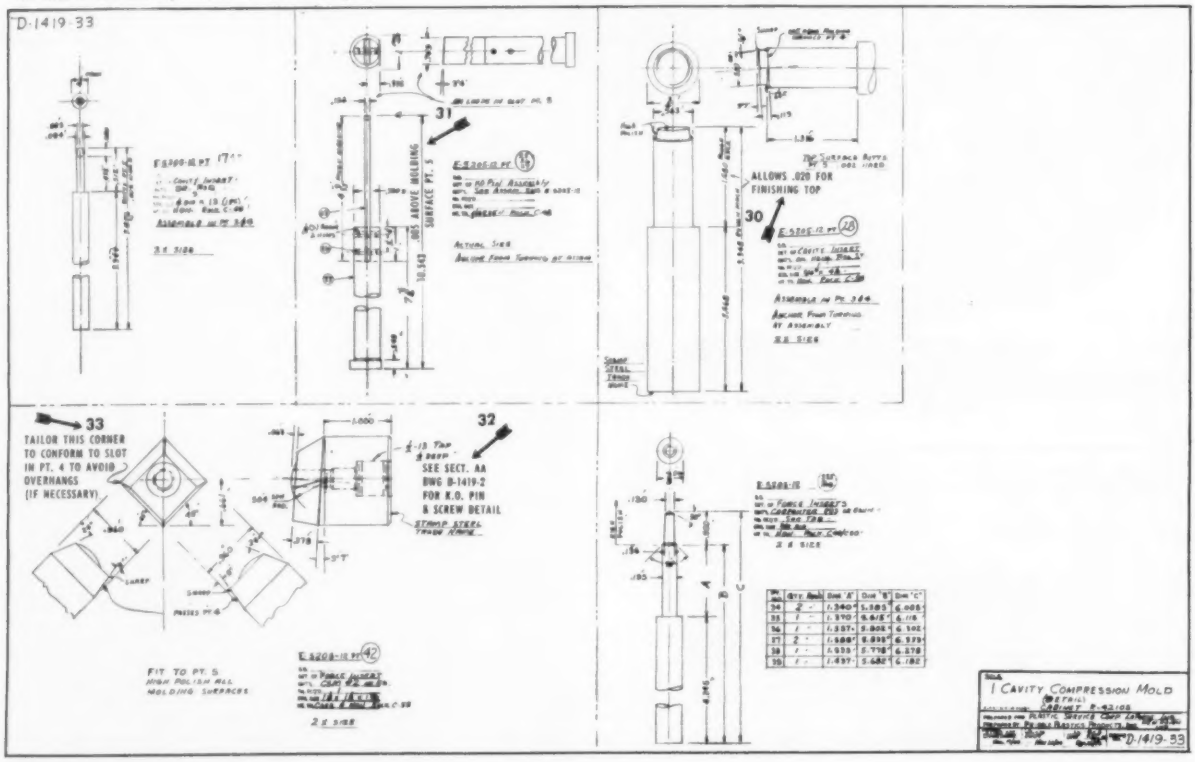
33) A final note says: "Tailor this corner to conform to slot in part 4 to avoid overhangs (if necessary)." The mold designer's job is done and there is still a degree of uncertainty—so the mold maker is told to use his own good judgment to make final adjustments.

Cost

This bird's-eye view of the mold designer's part in the production of a plastics product would not be complete without a few figures. In the case of the radio cabinet selected as an example, mold cost was in the $9000 to $9500 range. Design cost was $427.95. The cabinet sells for approximately 75¢ each, weighs 24 oz., and is molded of general-purpose phenolic material.

Fig. 6—Detail drawing of force and cavity inserts as well as knockout pin assemblies

All illustrations courtesy Pribble Plastics Products, Inc.



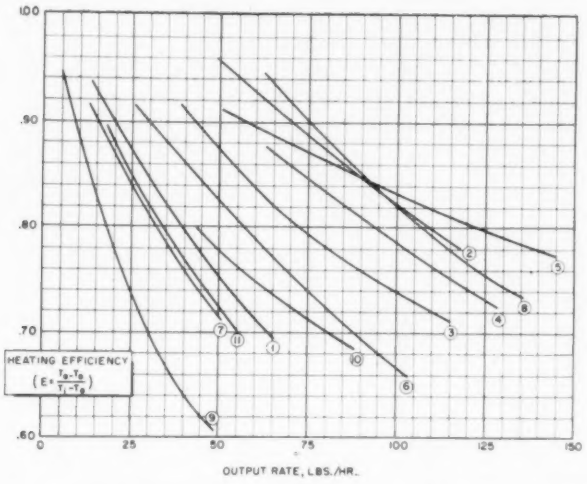


Fig. 1—Heating efficiencies of cylinders, uncorrected for size

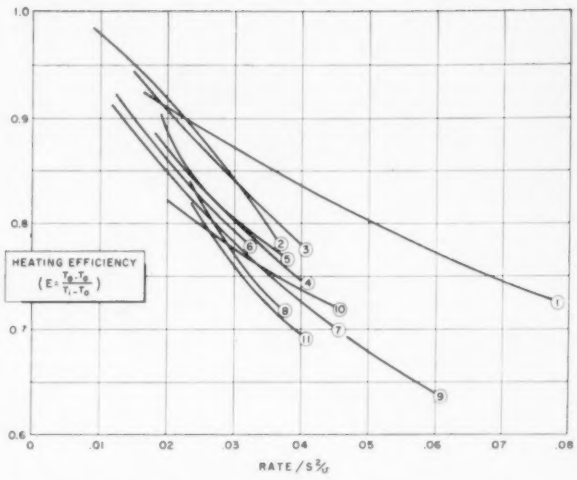


Fig. 2—Heating efficiencies of same cylinders, corrected for size

Temperature and Pressure Measurements in

The Injection Machine Heating Cylinder

by C. E. BEYER*, R. B. DAHL*, and R. B. McKEE*

The accompanying article is the third of a series of three papers dealing with fundamentals affecting the injection molding machine so far as the heating cylinder is concerned. These three papers were presented at the 11th Annual Technical Conference of the Society of Plastics Engineers, Inc. The first paper, published in the Plastics Engineering department of *Modern Plastics* in the April 1955 issue, gave details on experimental work in determining temperatures and pressure drop. The second article, treating with temperature variations in the heating cylinder, was presented in May. The third and last of the group considers the effect of design factors on heating cylinder performance.

THE research program described in the preceding articles has made it possible to draw some conclusions about heating chamber design. Some of the desirable qualities for an injection molding heating chamber can be enumerated as follows:

1) The chamber should have adequate plasticizing capacity. This means the ability to produce uniformly heated plastic at well above the maximum production capacity of the machine.

2) This plasticization should require a minimum of pressure loss.

3) The construction of the chamber should be leakproof and strong, yet it should be demountable for easy cleaning.

4) The flow path through the chamber should be smooth, with no dead spots. The surfaces should be uniformly heated, to assure fast plasticizing without overheating.

These conditions are, of course, difficult to achieve. Design features which improve heating capacity usually increase the pressure loss, and those designs which are most leakproof are welded and, therefore, difficult to disassemble. Heating chamber design is not all compromise, however; it is possible to improve performance without sacrificing desirable qualities. Since each machine and each molding job requires a somewhat different type of performance, the design factors which affect performance will be discussed from the aspects of plasticizing capacity and pressure loss.

* Plastics Basic Research Laboratory, The Dow Chemical Co., Midland, Mich.

Heating Performance

The heating performance of the cylinders used in the experiments described in these articles, plotted in Fig. 1, is the same heating efficiency referred to previously (ratio of actual temperature rise to maximum possible temperature rise) plotted against output rate in pounds per hour. Much of the recorded difference in performance is just a matter of size; a good big man generally beats a good small man. Size, when referring to a heat exchanger (whether it be a radiator or a heating chamber) is measured by surface and volume. The surface is considered because heat is transferred from surface to surface, and the more surface can be provided, the more heat will be transferred. The volume is considered because the heat conducted through plastic (or any other material) is inversely

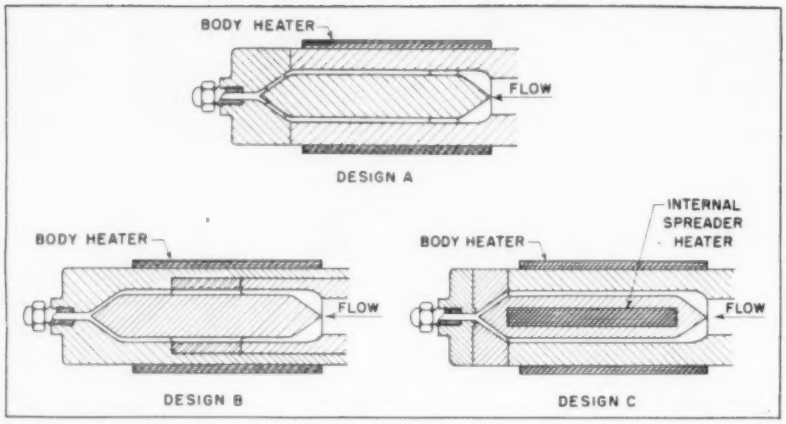


Fig. 3—Various conventional methods of incorporating spreader in heating chamber

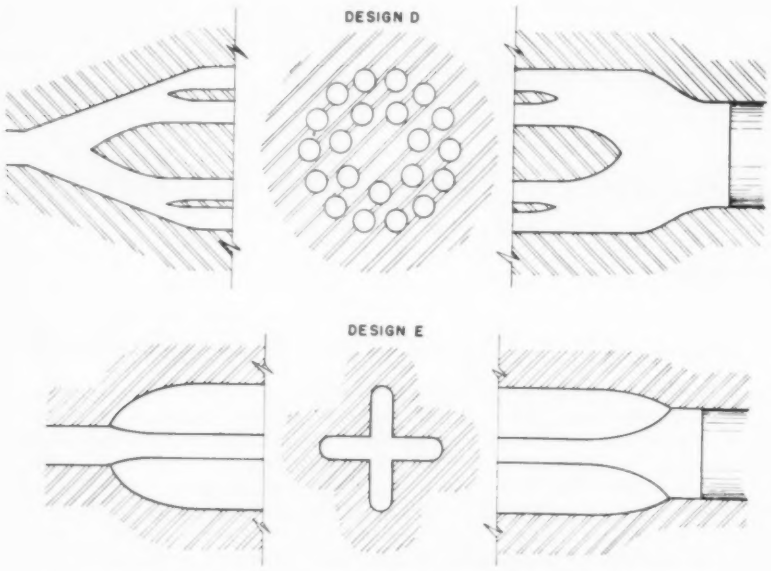


Fig. 4—Unconventional chamber designs used in investigating cylinder performance

related to the square of the distance. Naturally, the greater the volume, the larger the distance between surfaces.

These relations have been worked out mathematically to give the relation: Output equals a constant times (surface)^2/(volume). When the output rate of each chamber is divided by its S^2/V ratio, a compact grouping results (Fig. 2). After the performances are corrected for size, however, there are still differences. These differences may be shown more clearly by dividing the output of each machine (at a heating efficiency of 0.8) by its S^2/V ratio to give a performance factor. The chambers used in this research are listed in Table I in order of plasticizing capacity, and in Table II in order of performance factor. The differences between cylinder types may be explained by examining design of cylinders.

Cylinder Design

Most of the heating chambers in use today use a smooth cylindrical spreader inside a straight cylinder. This spreader, or torpedo, is often fastened at its downstream end, and fins used to support the upstream, or nose, end (Fig. 3, Design A). Another version of this scheme has the spreader fastened at midpoint by a heavy flange, through which holes are bored for plastic flow (Design B). A few manufacturers have placed electric cartridge heaters in the center of the torpedo (Design C). Also investigated was the performance of two unconventional

Table I—Influence of Cylinder Design on Plasticizing Capacity

Cylinder number	Machine size	Cylinder description	Plasticizing capacity
9	2½ oz.	Design E	17.5 lb./hr.
7	6 oz.	Design A	31.7 lb./hr.
11	8 oz.	Design A	33.5 lb./hr.
1	12 oz.	Design C—large heater	39 lb./hr.
10	8 oz.	Design A	42.5 lb./hr.
6	16 oz.	Design A	56.6 lb./hr.
3	16 oz.	Design C—small heater	72 lb./hr.
4	32 oz.	Design B	95 lb./hr.
8	120 oz.	Design A	107.4 lb./hr.
2	22 oz.	Design D	109 lb./hr.
5	66 oz.	Design B	123 lb./hr.

Table II—Performance Factors of Cylinder Designs

Cylinder number	Machine size	Cylinder description	Performance factor ($E = 0.8$)
1	12 oz.	Design C—large heater	0.051
2	22 oz.	Design D	0.034
3	16 oz.	Design C—small heater	0.032
4	32 oz.	Design B	0.032
5	16 oz.	Design B	0.032
6	16 oz.	Design A	0.028
7	6 oz.	Design A	0.027
8	120 oz.	Design A	0.027
9	2½ oz.	Design E	0.025
10	8 oz.	Design A	0.024
11	8 oz.	Design A	0.023

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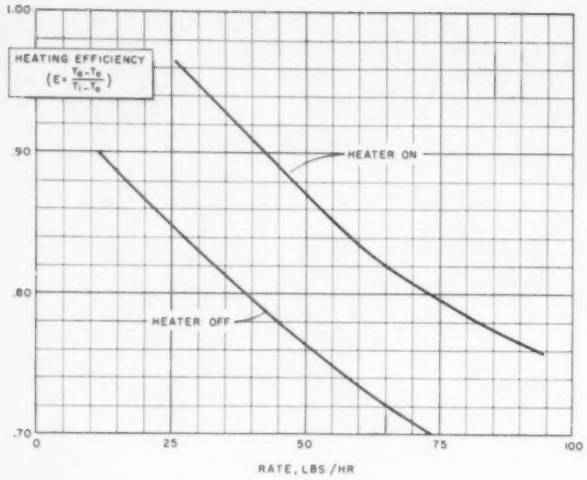


Fig. 5—Effect of torpedo heat on heating efficiency

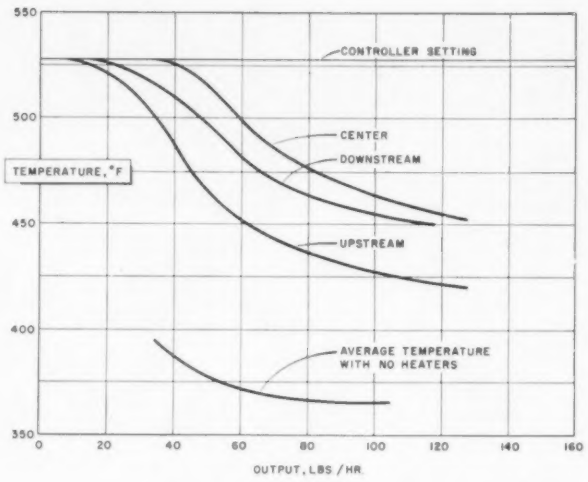


Fig. 6—Torpedo temperatures recorded during tests

types of chambers, one of which consists simply of 21 holes bored in a solid steel block (Fig. 4, Design D); the other has grooves cut into the sides of a cylinder, and no spreader (Design E).

The value of a heated torpedo is shown (Table II) by the performance factor of Design C. The superiority of Design B chambers over Design A chambers is probably due to the much shorter heat path from the main heater body to the torpedo nose. The heating surface in Design D chambers is uniformly heated throughout by the heavy metal section. Performance of chambers of Design E is decreased by the fact that a relatively large part of the plastic flow is in the center section, where the heating surface is small.

To demonstrate the effect of torpedo heat, one Design A chamber was run with the torpedo heater on, and with the heater turned off. The results (Fig. 5) show the improvement in performance with "central" heating, although the heater used was not adequate. The torpedo temperature, recorded during the runs (Fig. 6), illustrates need for a large amount of heat at torpedo nose.

Heat of Mechanical Energy

One of the more impressive things about a plastics extruder is the fact that, once started, it can deliver molten plastic with no heat at all supplied to the barrel. Often, in fact, heat must be removed to prevent over-heating. This phenomenon is no mystery to the physicist, who knows that a large amount of mechanical energy is being pumped into the plastic, which energy must appear somewhere as heat. The idea of heating plastic by pumping mechanical energy into it has the advantage of speed; the heat is created at the instant that the energy is dissipated. Also, the heat is created at the exact place where the energy is expended.

The instantaneousness of frictional heating is helpful when working with a thermoplastic that is extra sensitive to heat, because material breakdown is controlled by time as well as temperature. Temperature may be higher if the time is shorter. Temperature, however, is the most important; an increase of 6° C. can

(*To page* 135)

Fig. 7—Influence of friction on plastic heat content

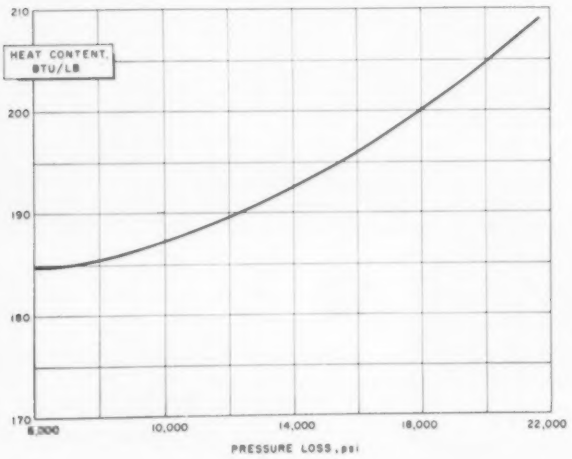
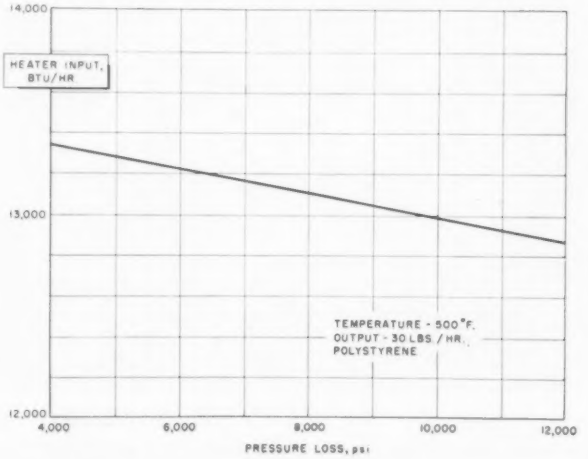


Fig. 8—Heat input vs. pressure loss for constant temperature



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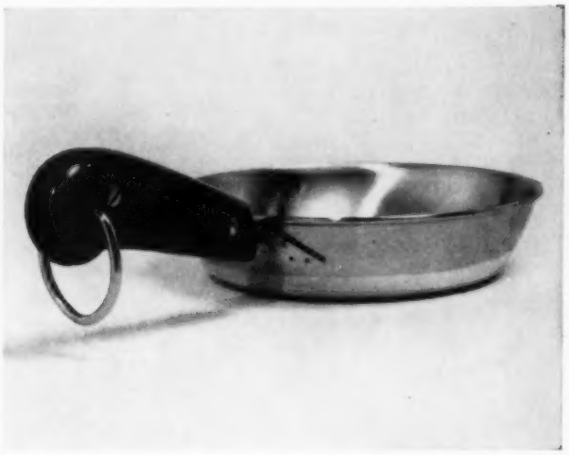
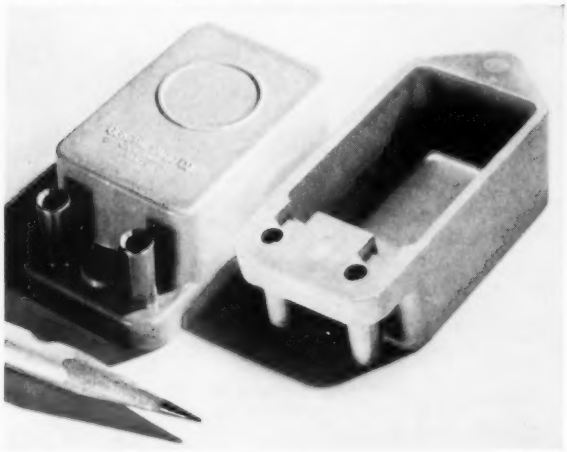


Heat resistance is on a par with handsome design when it comes to handles for cooking utensils. This one is molded from BAKELITE Heat-Resistant Phenolic BM-13335 Black—a two-step mineral-filled material with relatively low specific gravity. The handle is gracefully shaped, has a rich black color, and smooth surface. It gives a comfortable, safe, sure grip, won't get too hot to hold. This material can withstand intermittent exposure to temperatures up to 500 deg. F. (Handle molded for Revere Ware by Diemolding Corp., Canastota, N. Y., and Norton Laboratories, Lockport, N. Y.)



Superior electrical insulation is provided by BAKELITE "Low Loss" Insulation Phenolic BM-17748. Used for this capacitor housing, it reduces dissipation factor and leakage conductance. Other uses include vacuum tube bases, coil forms, and resistors. This material is also more resistant to moisture and more dimensionally stable than most phenolic molding materials. It is therefore recommended for many applications where superior electrical insulating qualities may be secondary. (Molded by Bay State Molding Co., Dorchester, Mass., for General Radio Co., Cambridge, Mass.)

Resistance to both impact and hot soapy water governs choice of a material for washing machine agitators. This one is molded in one piece from BAKELITE Improved Impact Phenolic BM-12315 Black. This two-step material possesses strength and moisture resistance under long periods of immersion, exposure to high humidities, and high immersion temperatures. The serpentine vanes are an unusual molding feature, but BM-12315 reproduced them with a glossy surface free of haze or flow marks. (Molded for the Whirlpool Corporation by Modern Plastics Corp., Benton Harbor, Mich.

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This big refrigerator panel is vacuum-formed from a single sheet of BAKELITE Brand High-Impact Styrene TGD-5001, a material developed especially for extrusion into sheets for subsequent postforming. Notice the excellent surface gloss and intricate details.

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Vacuum-formers appreciate the complex contours that can be achieved with sheets of TGD-5001 without danger of breaking on release. They like the fact that surface gloss is retained throughout the forming operation.

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Measuring 26 inches wide, 49 inches long, and 2½ inches at its deepest part, this refrigerator inner door panel typifies the large-sized, tough products that can be formed from BAKELITE High-Impact Styrene TCD-5001. It was produced by **General American Transportation Co.**, Chicago, Ill.

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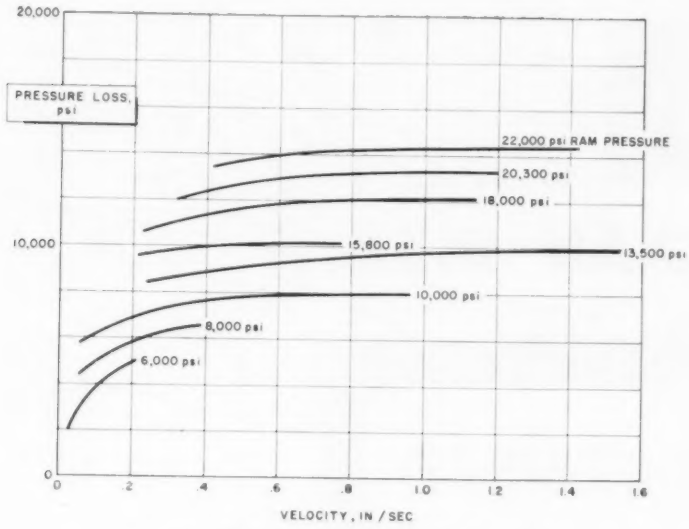


Fig. 9—Variations of pressure loss with flow rates

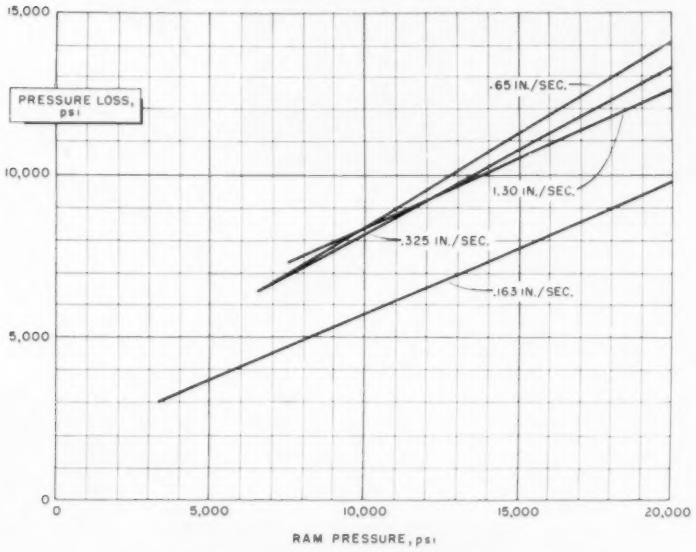


Fig. 10—Plot in Fig. 9 expressed as pressure loss vs. ram pressure

double the rate of material degradation.

The heat created by friction is not all absorbed by the plastic. To find out just where it goes, a heat balance can be run on the heating chamber through a range of pressures. The mechanical energy input is easily measured; the ram exerts a known force over a measurable distance. The electrical input to the heaters can be measured by timers, since the wattage is known. The heat output to the plastic is a little harder to evaluate, but a calorimeter carefully used gives good results. Figure 7 shows the increase in plastic heat content due to friction when the machine is operated on a constant cycle and at varying pressures. The power necessary to keep the cylinder up to temperature decreases as the pressure loss increases. This fact is graphically illustrated in Fig. 8, p. 130.

The energy output represented by these two measurements may be compared to the total energy input from the hydraulic cylinder; such a comparison shows that about 70% of the mechanical energy is transferred to the cylinder walls (where it helps the electric heaters, as shown in Fig. 8) and 30% appears in the plastic.

Frictional Heat Transfer

The fact that most of the friction heat is transferred to the cylinder walls shows that the heat is generated near the wall; otherwise, a larger portion would remain in the plastic, which is an excellent insulator. An examination of the plas-

Fig. 11—Effect of temperature on pressure loss in heating cylinder

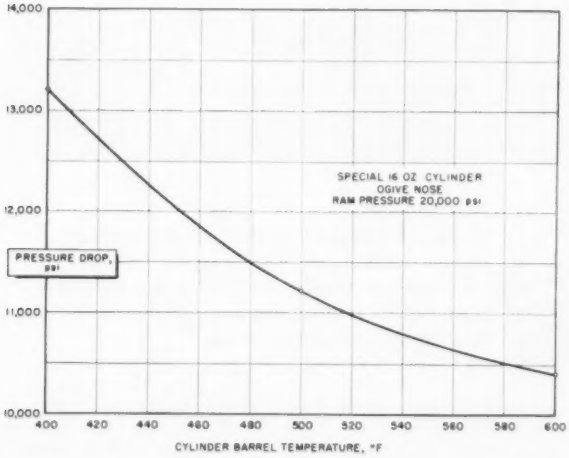
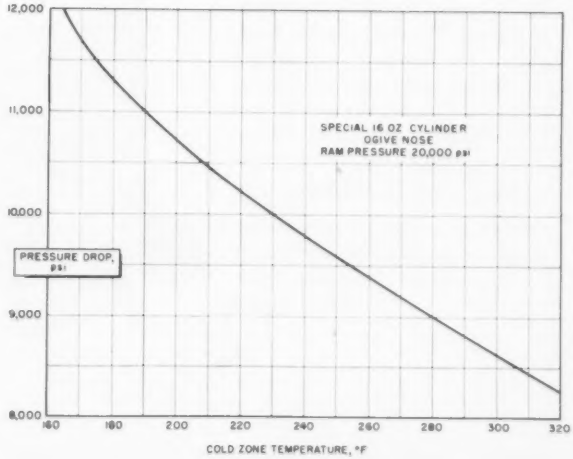


Fig. 12—Effect of temperature on pressure loss in granular zone



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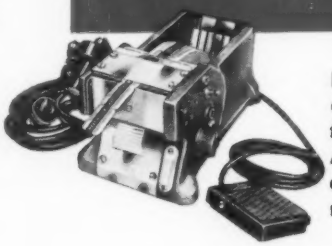

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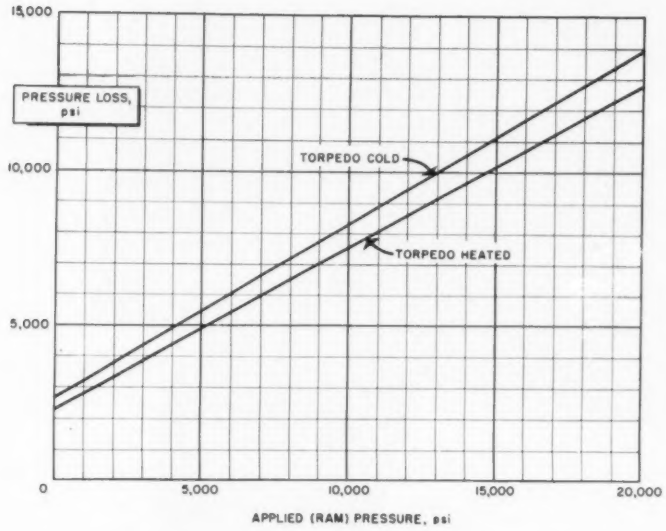


Fig. 13—Effect of torpedo temperature on total pressure loss

tic flow profile will help to explain why the heating is largely confined to the cylinder walls. The normal velocity profile of a liquid in a channel (when the flow is not turbulent) is parabolic; the velocity is zero at the wall and increases rapidly at first, the increase becoming less drastic until the center of the passage is reached. The shearing of the fluid is related to the location in the same way, for shear can be defined as the forcing of two elements of the same substance to move relative to each other.

It is characteristic of polymers that their viscosity is decreased by a shearing action. The decrease in viscosity where the velocity change (gradient) is most intense (near the wall) will tend to increase the gradient at this point. The result of this process is the "plug flow" characteristic of polymers, in which the material moves through the passage as though it were solid, lubricated by a thin film of liquid at the wall. Naturally, if all the shearing action is at the wall, the frictional heat will be concentrated at this point. It can be concluded, then, that in the absence of a vigorous mixing action (such as is found in an extruder), friction heating is largely non-uniform heating.

It can, therefore, be assumed that the plasticizing ability of a heating chamber will depend on: 1) the (surface)^2/ (volume) ratio; 2) uniform and adequate heating of all interior surfaces (especially the torpedo; and 3) adequate flow of material past all heating surfaces.

Pressure Loss

Second and by no means the least important facet of heating chamber performance is pressure loss. Using the fixture described previously, pressure losses have been measured under a variety of conditions. The variation of pressure loss with flow rate makes an interesting plot (Fig. 9). This relationship is unusual in two ways: the pressure loss does not continue to increase with velocity beyond a certain point (0.65 in./sec.) and the pressure loss is a function of the applied pressure. It appears that the fluid resistance increases with velocity; but that the coefficient of friction decreases at higher speeds. Since the pressure drop in the granular zone is a large part of the total, this decrease of friction coefficient offsets the natural increase in viscous pressure loss. The data of Fig. 9 may be cross-plotted to give the pressure drop-pressure relationship in Fig. 10. The decrease in slope above 0.65 in./sec. is an indication of the decrease in coefficient of friction.

Since the viscosity of molten polystyrene decreases with an increase in temperature, it would be expected that pressure loss in a heating chamber would decrease at the same time, and so it does (Fig. 11). For the same reason, an increase in temperature will decrease

Fig. 14—Diagrams of two torpedo nose designs

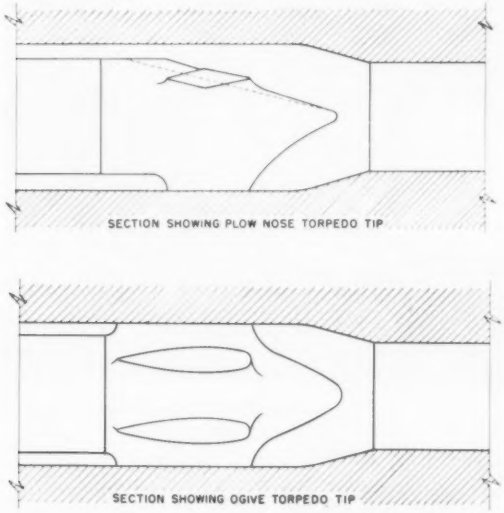
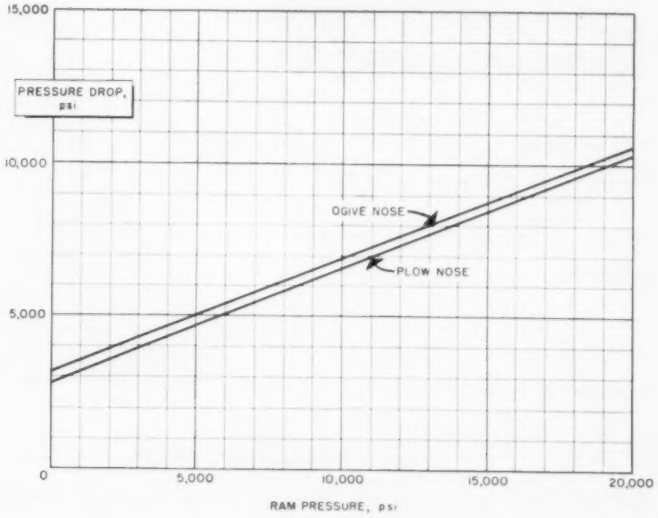


Fig. 15—Effect of torpedo nose design on pressure loss



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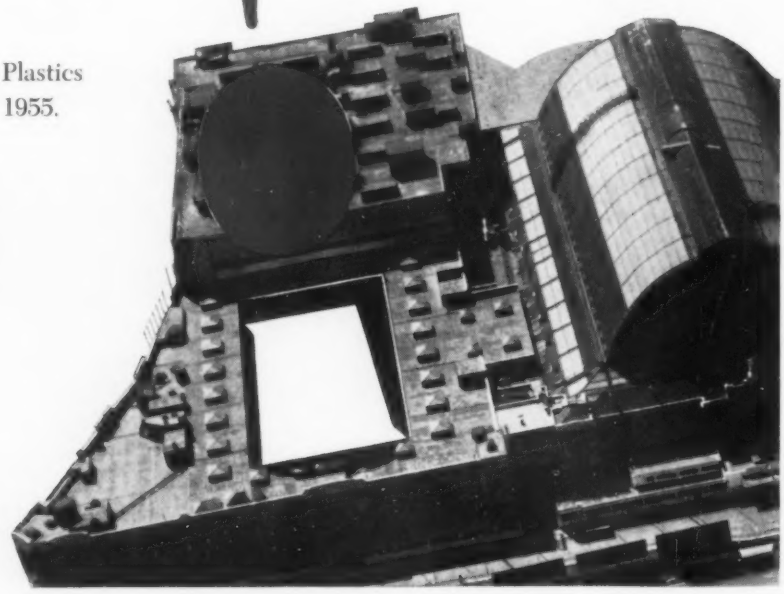

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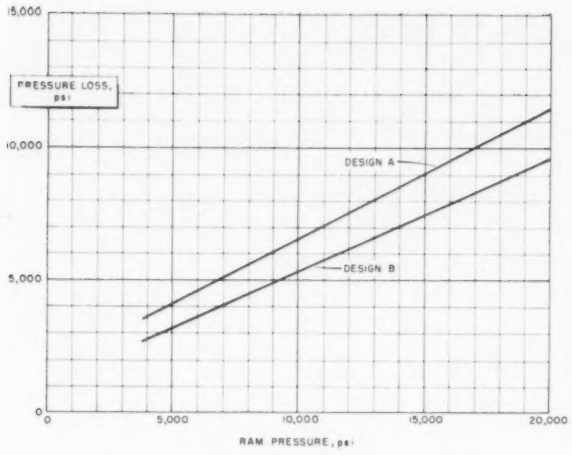


Fig. 16—Effect of flow areas around torpedo on pressure loss

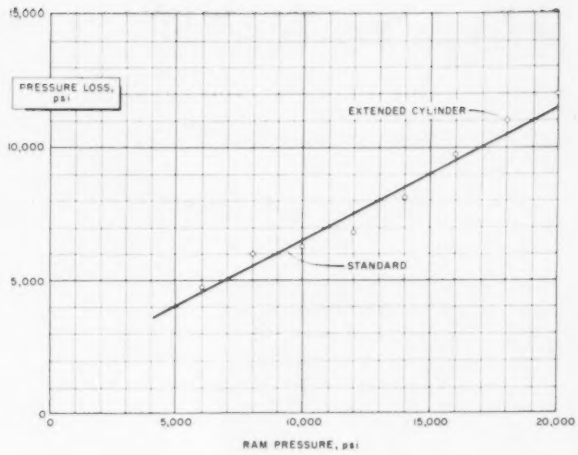


Fig. 17—Standard vs. extended cylinder and granular zone pressure

the pressure loss in the granular zone. The granular zone accounts for the major portion of the total pressure loss; consequently, the temperature of this zone has a large effect on the total pressure loss (compare Fig. 11 and Fig. 12). The torpedo heater on the machine used had a less important effect (Fig. 13) although the torpedo heater would be more important at faster cycles, where the heat demand is greater. The designs which promote better heating of the torpedo nose (such as Design B) should show less pressure loss, but no direct evidence is available. As the output of a heating cylinder is increased, the plastic temperature decreases. This decrease in temperature increases the pressure loss.

Torpedo Nose

A favorite topic of controversy among machine designers is the proper shape for a torpedo nose. In this work, a cylinder whose torpedo had an interchangeable nose was used. One nose was the standard "plow" with a sharp concave shape and three streamlined fins. The other nose was bullet shaped, with six heavy fins (Fig. 14). The plow nose showed less pressure loss (Fig. 15) but the difference is probably due to the larger cross-section for plastic flow.

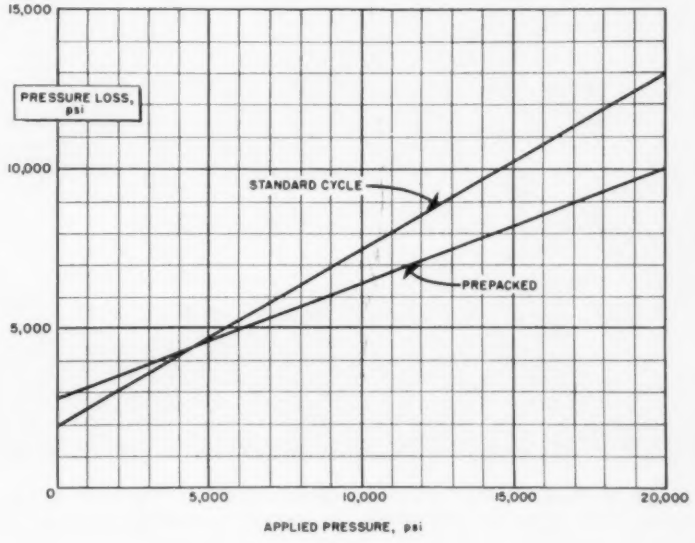
Torpedo Design

An important point in the design of the torpedo is whether the flow area around the nose is equal to the flow area upstream of the torpedo. At this point, the plastic is still in a granular state, except for the small amount of molten material at the walls. When the flow area decreases suddenly, this solid material is squeezed and forced to accelerate along the torpedo. If, on the other hand, the cylinder diameter is increased at the torpedo nose to provide a constant flow area, the granules are merely turned as they flow through this region. An example is the comparison (Fig. 16) between the pressure loss of two cylinders, one of which has a standard torpedo in a straight bore (Design A), the other (Design B) having the diameter arranged to avoid flow constriction at the nose. A contributing factor may be that the type B chamber has better heat supply to the nose.

One device for reducing pressure loss has been the use of an extended cylinder; that is, instead of having an inch or so of space between the plunger bottom position and the torpedo nose, 4 or 5 in. is provided. This increased inventory is intended to soften the plastic before it hits the torpedo. There is, of course, some melting, but it is confined to the area next to the cylinder walls. (It takes 4.6 hr. to bring the average temperature of a 4-in. diameter cylinder of plastic to 80% of the

(*To page* 234)

Fig. 18—Effective method of reducing granular zone pressure loss is prepacking, i.e., moving shot into cylinder under pressure immediately after previous injection



How to Rate Electronic Heat Sealers

Conventional square-inch ratings can be misleading; basis should be linear inches of conventional 1/16 in. wide seal

by PHILIP WEISS*

Fig. 1—When 8-by-2 in. die is set up in 2-kw. electronic heat sealer . . .

SEALING capacity of electronic heat sealers is usually rated in terms of the maximum area (expressed in square inches) of film or sheet which the unit can successfully seal during each cycle. To the plastic fabricator, this rating is important since it theoretically determines the size of the jobs which his equipment can handle on a profitable basis.

In calculating the maximum seal size obtainable with their equipment, fabricators have relied chiefly on machine ratings which list the maximum sealing area. On the production line, however, it is usually impossible to attain the maximum thus calculated.

Basic fallacy of the "square inch" method of computation is in the shape and size of the test sealing dies on which electronic heat sealing units are checked out.

Assume, for example, that a 100% continuous-duty, 2-kw. power output unit is being tested for a heat seal area rating and that the test is being run with an excellent grade of 20-gage vinyl sheet. In one such case, the 2-kw. unit was rated for "16 sq. in. of heat seal." The die that was used to confirm this rating (Fig. 1) was made of solid brass and measured 8 in. long by 2 in. wide, or an area of 16 sq. inches. The two pieces of 20-gage vinyl sheet being tested were so effectively sealed together over the entire 16-sq. in. area that they could not be pulled apart (Fig. 2).

Theoretically, then, this 2-kw. unit should be capable of sealing an area of 16 sq. in., regardless of the relative length and width of the sealed area. In actual practice, however, this is not the case.

For example, if the width of the sealing die is reduced to 1/16 in. (the most common die width in use today for producing heat-sealed seams), a 2-kw. unit rated for 16 sq. in. of heat sealing area should be able to produce a seam 256 in. long. To prove that this assumption is not true, a die consisting of 10 separate bars each measuring 25.6 in. in length and 1/16 in. in width (Fig. 3) was constructed. Satisfactory seals could not be made with this die on a 2-kw. machine, even though the total area to be sealed was still only 16 sq. inches. Two pieces of 20-gage vinyl sheet sealed with this die could be pulled apart with little effort (Fig. 4).

Basic reason for this reduction in sealing effectiveness that occurs as the length of the die increases and the width decreases, is the phenomenon known as "die loss." As the total number of linear inches in the perimeter of a die increases (while the area of the die remains constant) die loss increases proportionally; thus, the greater the perimeter of a die of given area, the greater the die loss.

Since the perimeter of the 8- by 2-in. die previously described is only 20 in. (Fig. 5) and the perimeter of the 256- by 1/16-in. die is 512 1/8 in. (Fig. 6)—more than 25 times longer—it becomes impossible to obtain a

*General Manager, Kabar Manufacturing Corp.

Photos courtesy Kabar Mfg. Corp.

. . . (Fig. 2) it seals two sheets of vinyl over 16-sq. in. area (8 by 2 in., as in Fig. 5) so that they cannot be pulled apart. On this basis, machine would be rated at 16 sq. in.

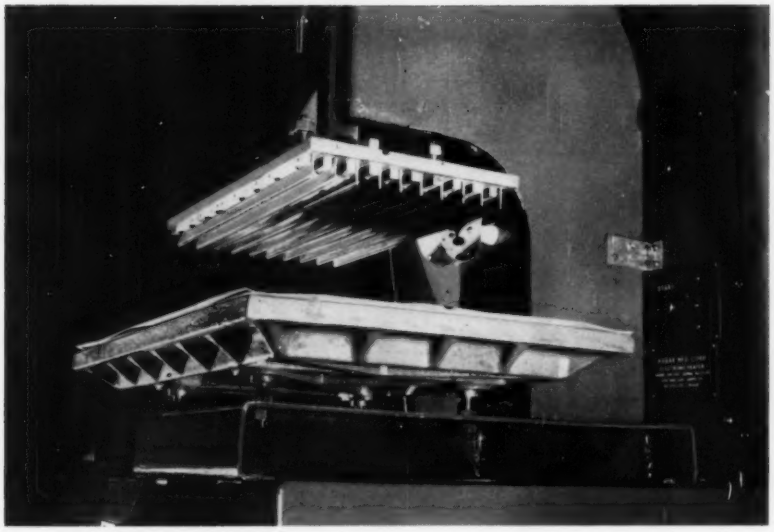


Fig. 3—If, however, another die, consisting of 10 bars, each 1/16 in. wide and having a total length of 256 in., is set up in same machine, the narrow seals between the . . .

Photos courtesy Kabar Mfg. Corp.

. . . (Fig. 4) two sheets of vinyl would be unsatisfactory; the sheets could easily be pulled apart, even though the total area of seal (see Fig. 6) still measured 16 sq. in.

Table I—Heat Sealing Capacity vs. Power Output and Vinyl Material Thickness

Power output		*Length of seal per 1/16 in. width*			
	Gage of sheet	*0.008 in.*	*0.016 in.*	*0.032 in.*	*0.040 in.*
kw.		*in.*	*in.*	*in.*	*in.*
1		18	20	25	30
2		38	48	55	65
2.9		60	70	80	90
4		90	100	115	125
5		105	125	135	150
6.5		120	150	165	185
8		135	175	200	235
10		175	225	275	325

satisfactory heat seal over the entire 256-in. length on a 2-kw. unit.

Since the majority of fabricators use sealing dies in production that are 1/16 in. wide, the "sq. in." method of rating is often misleading. Instead, a more logical approach would be to compute heat sealing capacity of a given machine by the linear inch on the basis of a 1/16 in. wide seal. The linear inch is the more important measurement in calculating production potential and the 1/16-in. width is a representative average of the size of seals most commonly used today.

From cumulative knowledge gleaned by research and practical experience, a chart has been developed (Table I, this page) that shows the linear inches of seal which can be expected from machines of given output, sealing material of given thickness. In working with electronic heat sealing equipment, it must be remembered that the thinner the material, the shorter the length of seal possible for a given power output because of heat absorbed by the die and bed.

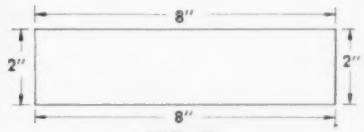


FIG. 5

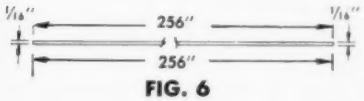


FIG. 6

The figures in Table I are conservative production ratings. They can be exceeded by 15% or more, if the user is sure that:

1) The *true* rated power output of the sealer is known.

2) Efficiency of the electrical coupling between the press, generator, and load is at maximum.

3) Plastic film or sheeting of high electronic sealing grade is used.

4) Stability of the a.-c. power source from which the generator works is assured.

5) The heat sealing die is of proper design and has good mechanical stability.

6) Sealing die is 1/16 in. wide.

7) Gage of material is the total thickness shown.

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PLASTICS*
TECHNICAL SECTION: Dr. Gordon M. Kline, Technical Editor

Measurement and Specification of Color and SMALL COLOR DIFFERENCES†

An international method of color identification known as the CIE (Commission Internationale d'Eclairage) System offers a means of quantitative color measurement as opposed to the qualitative color evaluations which have been used in the past. The color measurements are permanent and reproducible. They are made without involving human judgment, but they can be related to human experience.

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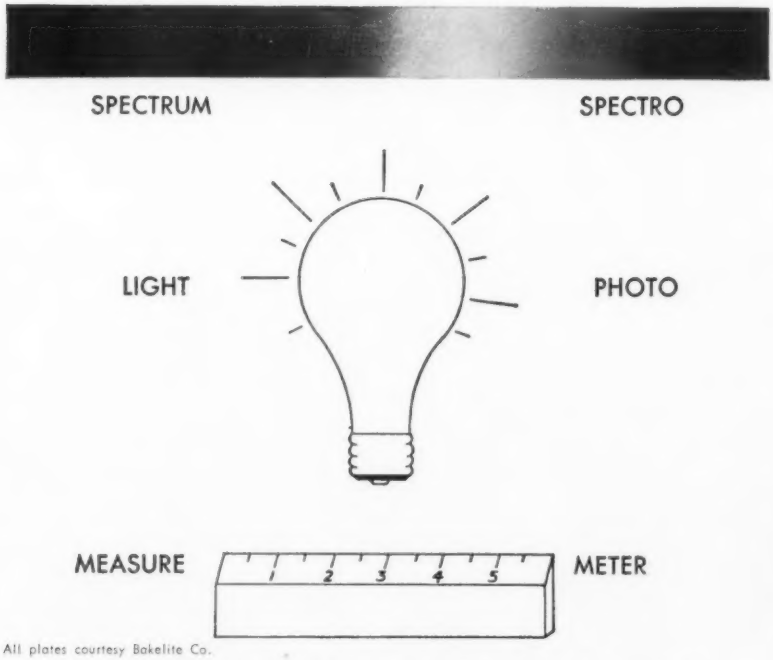
by W. J. GOODWIN‡

THIS information on color is presented in the nature of a review. It covers material that is familiar to the physicist and the color specialist, but this review should make its practical application to problems in the plastics industry more meaningful.

Quantitative color measurements are required to obtain reproducibility. Visual judgments are at best

* Reg. U. S. Pat. Off.
† A paper presented at the North Jersey Section, American Chemical Society Meeting-in-Miniature in Newark, N. J.
‡ Development Dept., Bakelite Co., a Div. of Union Carbide and Carbon Corp.



All plates courtesy Bakelite Co.

Fig. 1—*Spectro-photo-meter* is a device for *measuring light* from a *spectrum*

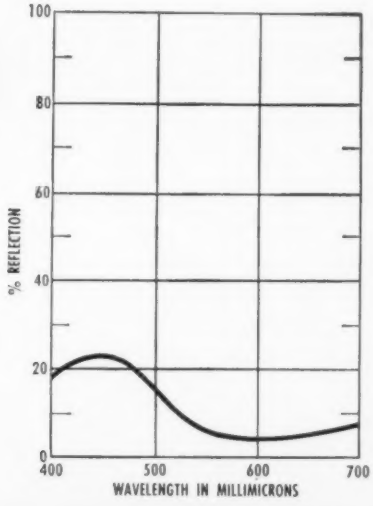


Fig. 2—Spectrophotometric curve of a blue material of the color shown

Fig. 3—Visible light, after passing through prism, is separated into spectrum

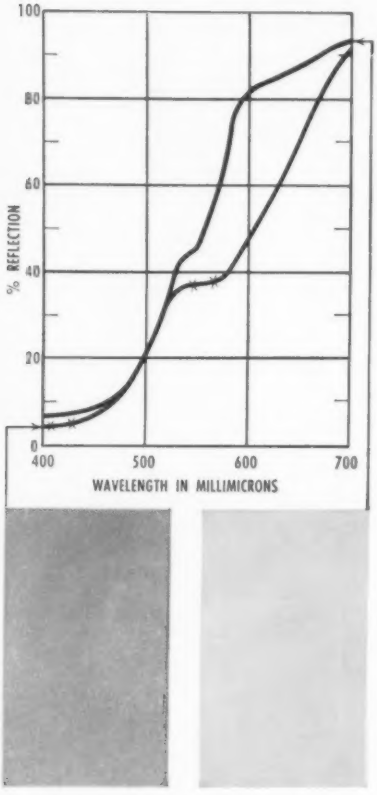


Fig. 4—Two yellow samples and their respective spectrophotometric curves (indicated by arrows left and right)

qualitative and involve many variables. Visual evaluation is remarkably sensitive to small color differences. However, color memory is so poor that colored materials must be compared side by side in order to take advantage of this sensitivity. Visual color judgments are limited in scope. They require years of experience to make their effective use possible.

The average person can distinguish between about two million colors. Since each color can be described with a minimum of three descriptive terms, it follows that six million descriptive terms are required to catalog these colors. If this is compared to an average vocabulary of 20,000 to 40,000 words, it is easy to understand why such a task of classification is beyond human ability.

The CIE system of color description and color measurement offers a means of making color measurements which are both quantitative and reproducible. A concise explanation of the system is given in the Handbook of Colorimetry by A. C. Hardy(1).[1] It represents the culmination of many years of experimentation.

This system was inaugurated in 1931 at a world-wide congress on color measurement. The letters "CIE" represent the first letter of each word of the French name for the congress. It was called *Commission Internationale d'Eclairage*. Initially it was called the International Commission on Illumination and was designed as ICI. ICI is a trademark in England and its use in other than this way is not permitted. A change in name was requested, and ICI became CIE.

The CIE system is based on the fact that a minimum of three primary colors are required to define any color. This is convenient since a parallel can be drawn between a three-dimensional space and a three-dimensional color solid. In either system three coordinates will locate a point. In the color solid this point represents a specific color. It is desirable to visualize some common concepts that will aid in understanding the color solid. The simplest color system that one could imagine involves the variation of only one dimension. It would be as if a person were color blind and could see only the variation in the black, white, and grays. The results of such a system can be illustrated by black and white photographs or television. Some animals are believed to have this type of vision.

A more complicated color system is a two-dimensional one. In such a system, black, white, gray, and a single hue such as green would be

[1] Numbers in parentheses link to references at end of article, p. 248.

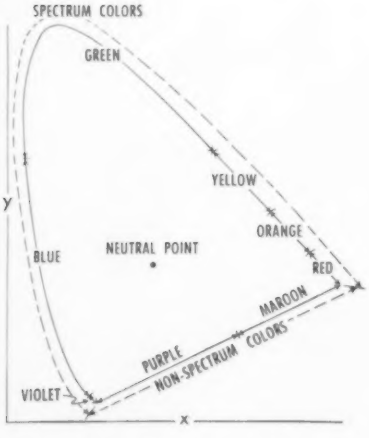


Fig. 5—Locus of spectrum and non-spectrum colors in chromaticity diagram

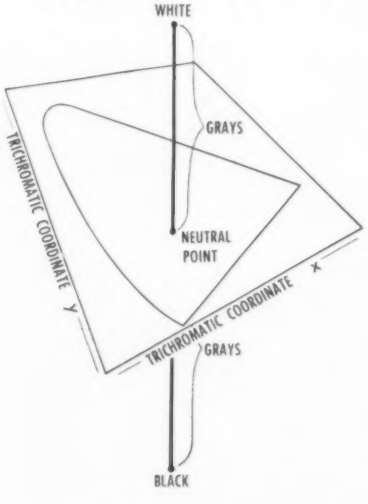


Fig. 6—Sketch showing relationship of neutral axis to chromaticity diagram

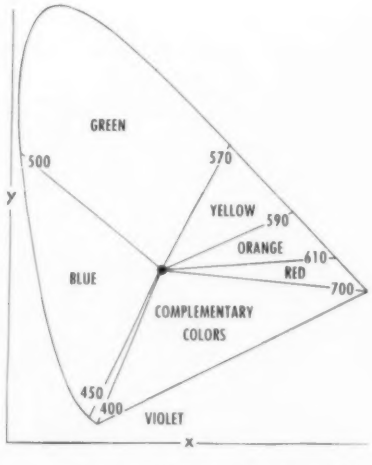


Fig. 7—Color divisions in chromaticity diagram according to common hues

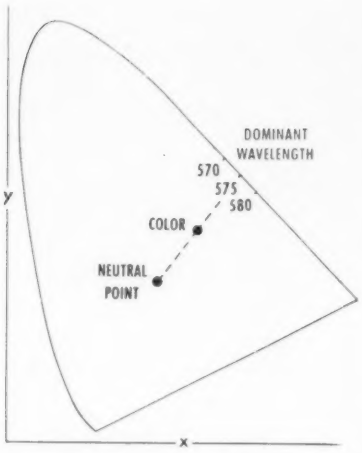


Fig. 8—Dominant wavelength of color located in chromaticity diagram

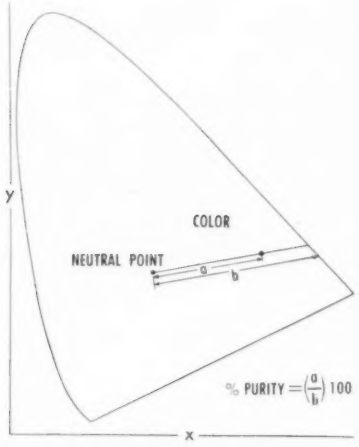


Fig. 9—Position of colors of same dominant wavelengths, different color purities

evident. The Wizard of Oz was able to approximate such a system by making every one wear green glasses.

A color system having three dimensions embraces all variations of color from black to white, from weak to strong colors, and all the hues. The mechanics involved in such a color system will be discussed in this paper.

Spectrophotometric Curves

In order that color measurement be precise and reproducible, some means of measurement that does not involve the human eye is required. Such a device is known as a spectrophotometer. It can be described from the component parts of its name: *spectro—photo—meter.* An explanation of its function is made in Fig.

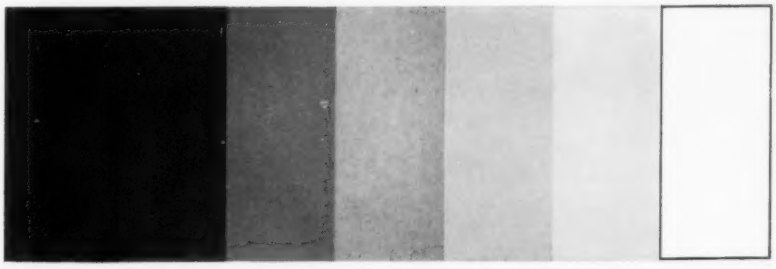


Fig. 10—Variations in lightness between black and light limits (neutral axis)

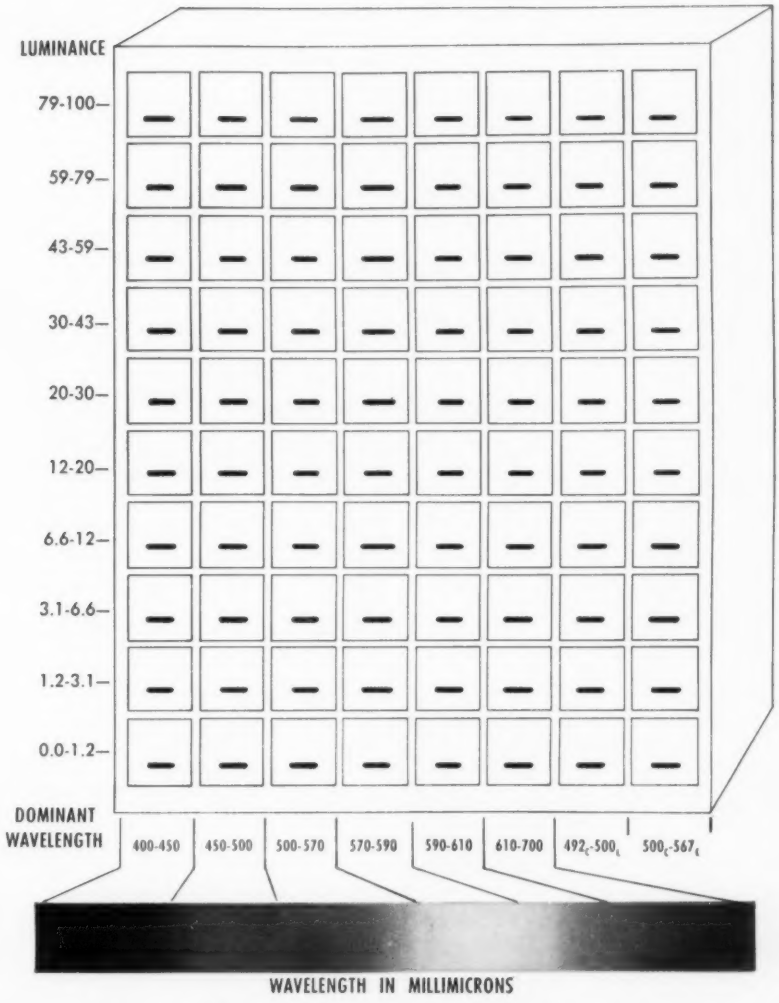


Fig. 11—Three-dimensional color file for easy location of any color sample

Fig. 12—"Just Noticeable Difference Unit" (JNDU), illustrated with neutral colors

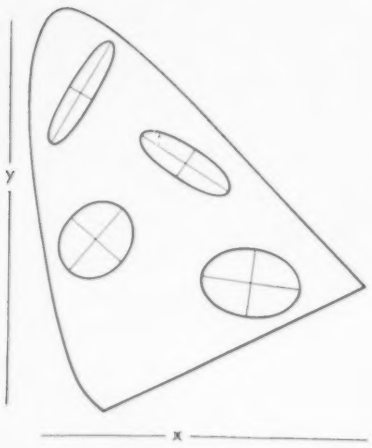


Fig. 13—Locus of one JNDU in chromaticity diagram, indicated by ellipses

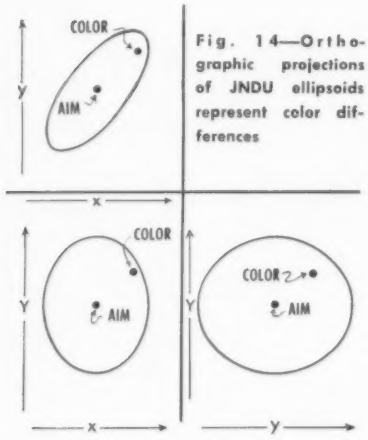


Fig. 14—Orthographic projections of JNDU ellipsoids represent color differences

1,[2] page 143. Here spectro refers to the spectrum, photo to light, and meter to measure. A spectrophotometer is defined as an instrument that measures the light of a spectrum transmitted by or reflected from a sample. If this device is a recording spectrophotometer, the record that is produced is called a spectrophotometric curve. A curve for a blue material is shown in Fig. 2, page 143. This curve is a plot of the quantity versus the quality of light from this sample. Quantity in this instance is obvious; quantity is expressed as percent transmission or reflection. The quality of the light parallels the hue concepts of red, yellow, etc., except that it is more specific and defines a variation of hue within any division. It is measured in terms of wavelength and the measurements expressed in units of millimicrons.

Visible light is the combination of a number of pure colored lights. When it is passed through a prism, it produces a spectrum composed of its component colors. A spectrum containing violet, blue, green, yellow, orange, and red hues is included in Fig. 3, p. 144. Each hue varies continuously and represents an infinite number of subdivisions. These bands are classified as to wavelengths as follows:

Wavelength range in millimicrons	*Hue*
400 - 450	Violet
450 - 500	Blue
500 - 570	Green
570 - 590	Yellow
590 - 610	Orange
610 - 700	Red

With a little experience it is possible to look at a spectrophotometric curve and make a qualitative estimate of what color it represents. In itself this information is no better than a visual evaluation. To make judgments of small color differences

(*To page* 235)

[2] Every effort has been made, within the limitations of commercial printing, to insure exact color reproduction in this article. However, unavoidable variations from copy to copy may introduce discrepancies if the reproduced colors are subjected to spectrophotometer measurement.

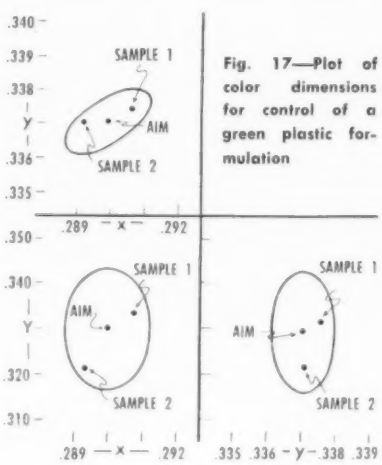
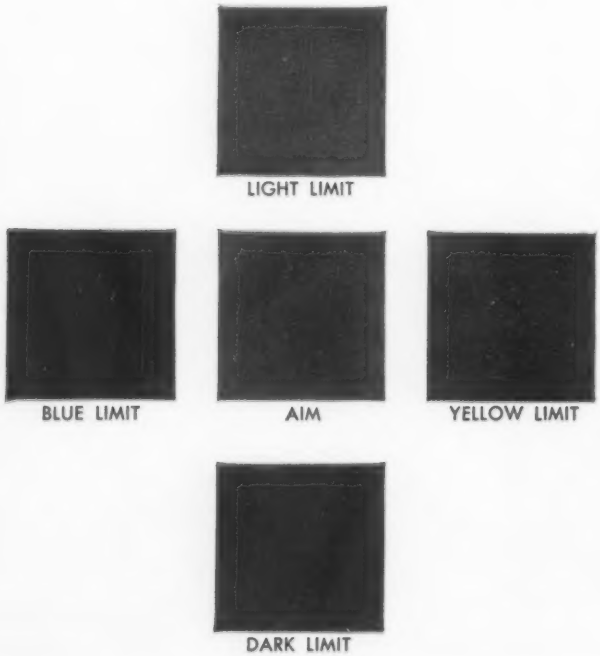


Fig. 17—Plot of color dimensions for control of a green plastic formulation



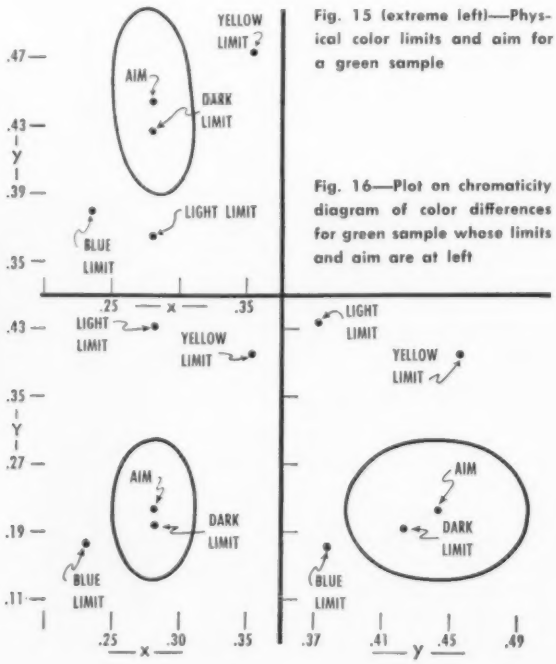


Fig. 15 (extreme left)—Physical color limits and aim for a green sample

Fig. 16—Plot on chromaticity diagram of color differences for green sample whose limits and aim are at left

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Viscosity Stability of Plastisols

by J. R. DARBY* and P. R. GRAHAM*

THE use of vinyl dispersions, particularly plastisols, has increased sharply since the advent of the vinyl stir-in paste resins. A large number of plastisol operations, including cloth and metal coating, slush molding, and foam formation have appeared on the vinyl scene.

Although every plastisol formulator must be primarily concerned with the end-use properties of his formulations (enduring compatibility, heat and light stability, extraction resistance, etc.), he is ever cognizant of the viscosity problems associated with his particular process or those encountered through the storage of his formulation before use. Depending upon the facilities involved, storage temperatures might range from 25 to 50°C. (77 to 122°F.) for days or even weeks. Moreover, he must also keep in mind the fusibility of his plastisol at high temperatures. It is the task of the vinyl formulator, then, to control both viscosity build-up and the fusion properties through careful selection of each constituent in his formulation.

Because of the uniformity of the high grade vinyl paste resins obtainable today, the control of flow properties of plastisols is primarily one of varying the amount and type of plasticizer dispersant. There are plasticizers that impart a broad range of properties to plastisols, from the fast fusion obtained with the high-solvating plasticizers to the low viscosity effects produced by the low-solvating plasticizers. The effect of plasticizers on fusion has been shown previously in Banbury- and paper-coating studies (1, 2).[1]

In order to show the effects of storage temperature and time on dispersions prepared from a variety of plasticizers, plastisols were stored at temperatures representing the range of conditions found in plant storage. No results are included for temperatures below 25°C., inasmuch as viscosity build-up is very slow below this temperature.

* Research Dept., Organic Chemicals Div., Monsanto Chemical Co.

[1] Numbers in parentheses link to references at end of article, p. 250.

Procedures and Equipment

Preparation of Plastisols — Unless otherwise stated, all plastisols investigated contained 80 parts of plasticizer per 100 parts of resin (p.h.r.). Approximately one-half of the plasticizer was added to all of the resin in a Model N-50 Hobart mixer and stirred for 1 min. at the lowest speed. The remainder of the plasticizer was added over a period of 2 min. with constant mixing. The complete plastisol was then mixed for 45 minutes. The temperature was maintained at 25±1°C. during the mixing operations. No other in-

Table I—Effects of Resins on Plastisol Shelf-Life

	Viscosity[a] in poises							
	Formula 1				Formula 2			
	Geon 121 100				Opalon 410 100			
	DOP 65				DOP 65			
Speed of viscometer spindle, r.p.m. →	6	12	30	60	6	12	30	60
25° C.								
4 hr.	80	82	78	78	82	75	67	64
1 day	115	111	98	95	115	112	100	94
7 days	186	170	144	—	141	138	133	—
14 days	225	202	169	—	180	158	133	—
21 days	238	215	184	—	180	166	138	—
28 days	216	205	191	—				
40° C.								
4 hr.	78	72	62	56	107	94	76	65
1 day	197	162	131	—	243	186	133	99
7 days	570	435	—	—	475	347	—	—
14 days	757	—	—	—	670	434	—	—
21 days	615	—	—	—	750	—	—	—
28 days	940	—	—	—				
50° C.								
4 hr.	320	250	183	—	302	222	143	—
1 day	1000	—	—	—	1000	—	—	—

[a] Measured with Brookfield LVF viscometer.

Table II—List of Materials and Suppliers

Tradename or abbreviation	Chemical name	Supplier[a]
DOP	Di-2-ethylhexyl phthalate	(1)
DIDP	Di-isodecyl phthalate	(1)
DNODP	Di(*n*-octyl, *n*-decyl) phthalate	(1)
DIOP	Diisooctyl phthalate	(1)
Santicizer[b] 160	Butyl benzyl phthalate	(1)
Flexol[b] CC-55	Di-2-ethylhexyl hexahydrophthalate	(2)
Santicizer[b] 140	Cresyl diphenyl phosphate	(1)
Santicizer[b] 141	Alkyl aryl phosphate	(1)
TCP	Tricresyl phosphate	(1)
Flexol[b] TOF	Tri-2-ethylhexyl phosphate	(2)
DOA	Dioctyl adipate	(1)
DIDA	Di-isodecyl adipate	(1)
Santicizer[b] B-16	Butyl phthalyl butyl glycolate	(1)
HB-20[b]	Aromatic hydrocarbon	(1)
HB-40[b]	Aromatic hydrocarbon	(1)
Sovaloid[b] C	Aromatic hydrocarbon	(3)
Aroclor[b] 1254	Chlorinated polyphenyls	(1)
Aroclor[b] 5460	Chlorinated polyphenyls	(1)
Geon[b] 121	PVC paste resin	(4)
Opalon[b] 410	PVC paste resin	(1)
Atomite[b]	Calcium carbonate filler	(5)

[a] Code for suppliers:
(1) Monsanto Chemical Co.
(2) Carbide and Carbon Chemicals Corp.
(3) Socony Vacuum Oil Co.
(4) B. F. Goodrich Chemical Co.
(5) Thompson-Weinman Co.

[b] Trademark of supplier, reg. U.S. Pat. Off.

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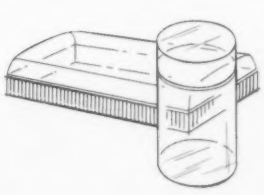

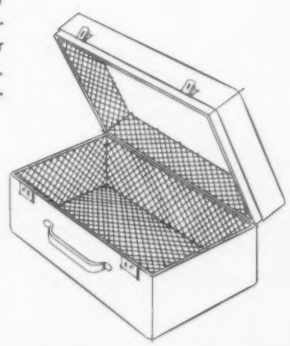

gredients were added unless specifically mentioned.

Storage of Plastisols — Each plastisol was divided into three portions and placed in 8-oz. bottles. These bottles were stored at 25, 40, and 50°C. The viscosities of these plastisols were measured at regular intervals at the storage temperatures involved.

Measurement of Viscosity — All viscosity measurements were made with the Brookfield LVF viscometer using the No. 4 spindle at 6, 12, 30, and 60 r.p.m. It is realized that other instruments are available that were designed particularly for the measurement of the non-Newtonian flow properties of this type of system (3, 4). However, a Brookfield LVF viscometer was selected for viscosity measurement because of its versatility and its popular usage for platisol control work in production plants.

Table I, p. 148, shows type of data collected at any set of determinations. Although data were collected at the four rotational speeds in every case, the mass of figures was so bulky that a value obtained at 12 r.p.m. has been selected in order to make the results more manageable.

Materials Used — Table I shows that both Opalon 410 (Monsanto Chemical Co. paste resin) and Geon 121 (B. F. Goodrich Chemical Co. paste resin) have equivalent viscosity properties. A single batch of one of these resins was used for this study. This potential variable was thereby held constant throughout this investigation.

The sources of the plasticizers and other materials used in this investigation are listed in Table II, p. 148. This table also lists the various tradenames or abbreviations found in this article.

Effects of Ester-Type Plasticizers

Table III shows clearly the pronounced effect plasticizers have on viscosity stability. Di-isodecyl phthalate (DIDP)[2] and particularly di-isodecyl adipate (DIDA)[2] plastisols show remarkable viscosity stability at all temperatures considered. They were the only dispersions remaining fluid after a few days exposure to 50°C. Moreover, their viscosities remained low even after 100 days at that temperature.

The opposite effect is noted in plastisols containing the more resin-

[2] These esters (DIDP and DIDA) were prepared from "isodecyl" alcohol obtained from the addition of carbon monoxide to olefins under high pressure with subsequent hydrogenation. This is known as the "oxo" process.

Table III—Effects of Storage Temperature and Time on Brookfield Viscosity of Plastisols

Plastisol No.	Plasticizer 80 p.h.r.	Viscosity[a] in poises														
		25°C.					40°C.					50°C.				
		Initial[b]	1 day	7 days	14 days	28 days	Initial[b]	1 day	7 days	14 days	28 days	Initial[b]	1 day	7 days	14 days	28 days
1	Dioctyl phthalate (DOP)	36	65	97	116	132	37	84	215	305	426	66	Gel			
2	Di-isodecyl phthalate (DIDP)	45	75	98	86	80	31	50	80	110	120	50	104	186	230	300
3	Di-(*n*-octyl, *n*-decyl) phthalate	22	32	38	42	46	25	44	70	89	112	105	458	Gel		
4	Di-isooctyl phthalate (DIOP)	38	90	147	146	158	32	86	204	223	316	122	Gel			
5	Santicizer 160	35	50	120	118	164	37	163	Gel			Gel				
6	Flexol CC-55	32	48	80	110	120	37	70	152	228	250	86	260	700	Gel	
7	Santicizer 140	31	45	52	42	56	32	65	80	123	220	285	Gel			
8	Santicizer 141	36	66	184	255	450	166	Gel				Gel				
9	Tricresyl phosphate (TCP)	45	58	89	68	91	60	108	190	266	412	296	Gel			
10	Flexol TOF	16	24	30	38	38	16	45	85	100	150	61	226	Gel		
11	Dioctyl adipate (DOA)	14	36	46	52	65	19	70	107	118	90	41	192	Gel		
12	Di-isodecyl adipate (DIDA)[c]	12	12	22	24	23	12	18	23	26	18	16	28	36	38	31
13	Santicizer B-16	55	75	172	182	162	64	315	Gel			Gel				
14	DIDP/S-160 (3:1)	38	52	133	122	204	32	62	178	272	322	46	150	Gel		
15	DIDP/S-160 (1:1)	46	60	133	128	217	59	130	375	950	Gel	900	Gel			
16	DIDP/S-160 (1:3)	45	65	164	268	250	52	180	980	Gel		162	Gel			
17	DIDP/S-141 (3:1)	32	45	56	94	128	40	58	108	122	179	128	240	Gel		
18	DIDP/S-141 (1:1)	34	—	—	147	178	42	143	295	750	Gel	780	Gel			
19	DIDP/S-141 (1:3)	38	43	84	160	218	86	263	Gel			Gel				
20	DOP/HB-20 (3:1)	25	31	36	31	32	21	46	61	72	100	66	400	870	Gel	
21	DOP/HB-40 (3:1)	40	54	61	58	79	34	85	86	92	146	81	950	Gel		
22	DOP/Aroclor 1254 (3:1)	49	63	78	75	148	48	98	108	110	209	94	660	980	Gel	
23	DOP/Aroclor 5460 (3:1)	92	154	161	178	252	68	136	139	164	274	100	470	900	Gel	
24	DOP/Sovaloid C (3:1)	32	68	57	—	—	51	109	112	—	—	85	400	>1000		
25	DIDP with 10 p.h.r. Atomite	62	95	140	126	170	35	70	138	144	185	48	166	262	242	275
26	DIDP with 20 p.h.r. Atomite	110	140	164	195	192	75	136	207	186	280	84	230	275	333	800
27	DIDP with 40 p.h.r. Atomite	204	250	335	315	340	159	200	225	272	250	180	290	495	Gel	
28	DIDP with 50 p.h.r. Atomite	315	340	371	408	428	200	210	255	255	—	248	396	445	308	Gel
29	DOP with 10 p.h.r. Atomite	62	104	164	184	202	40	102	301	326	375	76	990	Gel		
30	DOP with 20 p.h.r. Atomite	75	115	244	256	308	59	154	375	424	720	208	Gel			
31	DOP with 40 p.h.r. Atomite	194	290	345	402	335	170	325	410	950	870	336	Gel			
32	DOP with 50 p.h.r. Atomite	295	375	468	450	490	232	400	727	870	Gel	490	Gel			

[a] Measured with Brookfield LVF viscometer, #4 Spindle at 12 r.p.m. [b] Viscosity taken 4 hr. after preparation. [c] Phase separation was noted after 80 days storage at 25° C.

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Basic Lead Carbonate	1.6
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COST					
Pound Volume Cost of Compound	45.5¢	48.8¢	46.6¢	45.8¢	45.9¢
VOLATILITY[2]					
@ 70° C. – Weight Loss %	0.75	0.75	0.92	1.6	1.2
@ 90° C. – Weight Loss %	3.6	3.6	3.3	6.0	5.5
LOW TEMPERATURE PROPERTIES					
Clash and Berg – Tf[3]	−29.4 C.	−30.5°C.	−29.3°C.	−28.4°C.	−30.3°C.
Brittleness – SPI Impact[4]					
Passed	−35.0 C.	−35.0°C.	−30.0°C.	−30.0°C.	−30.0°C.
Failed	−40.0 C.	−40.0°C.	−35.0°C.	−35.0°C.	−35.0°C.

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CABFLEX®DDP (di-decyl phthalate)

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CABFLEX®DOA (di-2-ethylhexyl adipate)
CABFLEX®ODA (iso-octyl decyl adipate)
CABFLEX®DDA (di-decyl adipate)

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CABFLEX®TCP (tricresyl phosphate)
CABOL®100 (hydrocarbon oil plasticizer)

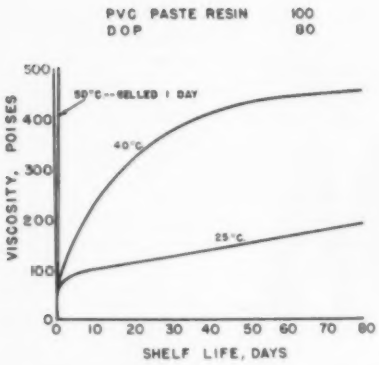

Fig. 1—Viscosity build-up of DOP plastisol at various storage temperatures

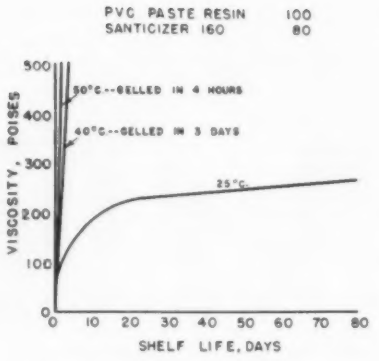

Fig. 2—Viscosity build-up of S-160 plastisol at various storage temperatures

solvating type plasticizers, such as Santicizer 160 (butyl benzyl phthalate) and Santicizer 141 (an alkyl aryl phosphate). They became very viscous in a short time at 25°C. and gelled solid in a matter of hours at 40 and 50°C.

Heretofore it has been common practice to rule out the use of these latter type plasticizers because of their tendency to build up viscosity rapidly. However, in many operations it is feasible to process a dispersion after a relatively short storage period in order to take economic advantage of the ability of the solvating-type plasticizer to fuse readily. It would require less heat and time to obtain a product of optimum physical properties.

Figures 1, 2, 3, and 4 show graphically the viscosity influence of four phthalate plasticizers at different temperatures. The DOP-based plastisol depicted in Fig. 1 is illustrative of the viscosity change problem, particularly at elevated temperatures. Figure 2 shows that Santicizer 160 has appreciably aggravated the viscosity control problem at elevated temperatures. Di(*n*-octyl, *n*-decyl)phthalate (DNODP) in Fig. 3 exhibits relatively good viscosity control until the temperature exceeds 40°C. DIDP showed exceptional viscosity stability at all temperatures tested (Fig. 4).

Depending upon the viscosity requirements of the process itself and the length of storage time anticipated, a "tailor-made" plastisol can be prepared. An appropriate mixture of the low-solvating-type plasticizer to obtain good viscosity shelf-life plus a high-solvating plasticizer to give better fusion at elevated temperatures is the way to accomplish a balanced formulation. Figure 5, p. 154, shows the viscosity control that is possible with plastisols containing DIDP in various concentrations with both Santicizer 160 and Santicizer 141. These curves show that at 25°C. storage conditions, both sets of mixtures (DIDP/S-141 and DIDP/S-160) rise in viscosity slightly as the amount of solvating-type plasticizer is increased. This rise in viscosity at 25°C. is not pronounced and in some instances the type of measurement could not detect it. This was true in the case of the DIDP/S-141 mixtures, where a 40-40 mixture of the two plasticizers was more viscous than a 60-20 mixture, composed primarily of Santicizer 141. As the storage temperature increased to 40°C., however, the differences become more apparent and the dispersions gel in the order of the increasing amounts of solvating-type plasticizer. At 50°C., the other extreme is reached, and all of the dispersions containing Santicizer 141 or 160 gel early.

It is possible, then, to utilize these mixtures of the two types of plasticizers to obtain plastisols having viscosity properties in the same range as a straight DOP formulation. The advantage obtained through mixing might be one of economy or it might be the acquisition of a special property, such as extraction resistance, not available in DOP formulations.

Occasionally it may be necessary to impart flame resistance to a plastisol formulation. In this case a phosphate-type plasticizer should be used. It is interesting to note the range of viscosity properties (Table II) available from the phosphates. If a low viscosity dispersion is needed, trioctyl phosphate or Santicizer 140 (cresyl diphenyl phosphate) may be used. Santicizer 140 is more flame retardant. If rapid fusion is desired, Santicizer 141 would be best for this application. These plasticizers might be mixed with the appropriate phthalate plasticizers to get a desirable balance of both flame retardance and viscosity control.

Effects of Fillers

To reduce cost, many formulations include inert fillers in amounts ranging up to 50 parts per 100 parts of resin. The use of these products causes an increased initial viscosity and curtails the viscosity shelf life of the plastisol. As in the unfilled systems, this effect becomes much more pronounced when the storage temperature is elevated. Table II lists DOP and DIDP plastisols containing Atomite at several concentrations. It is shown that

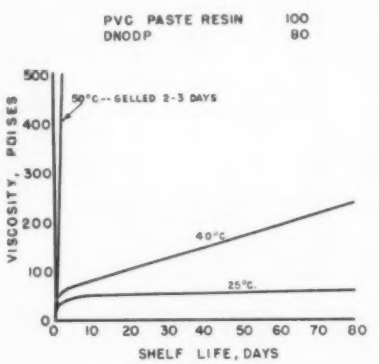

Fig. 3—Viscosity build-up of DNODP plastisol at various storage temperatures

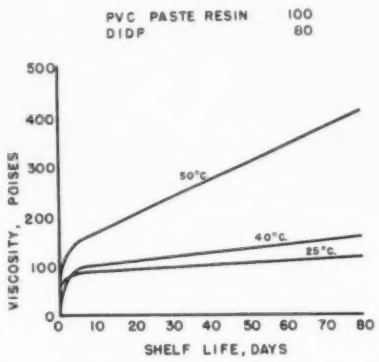

Fig. 4—Viscosity build-up of DIDP plastisol at various storage temperatures

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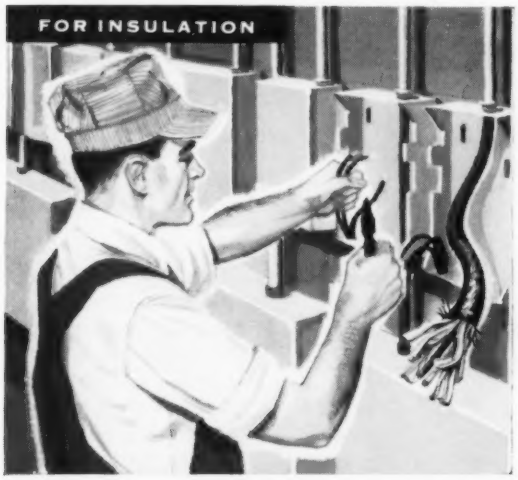

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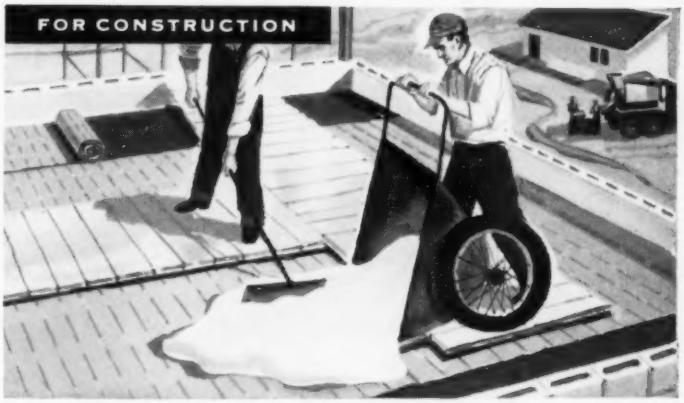

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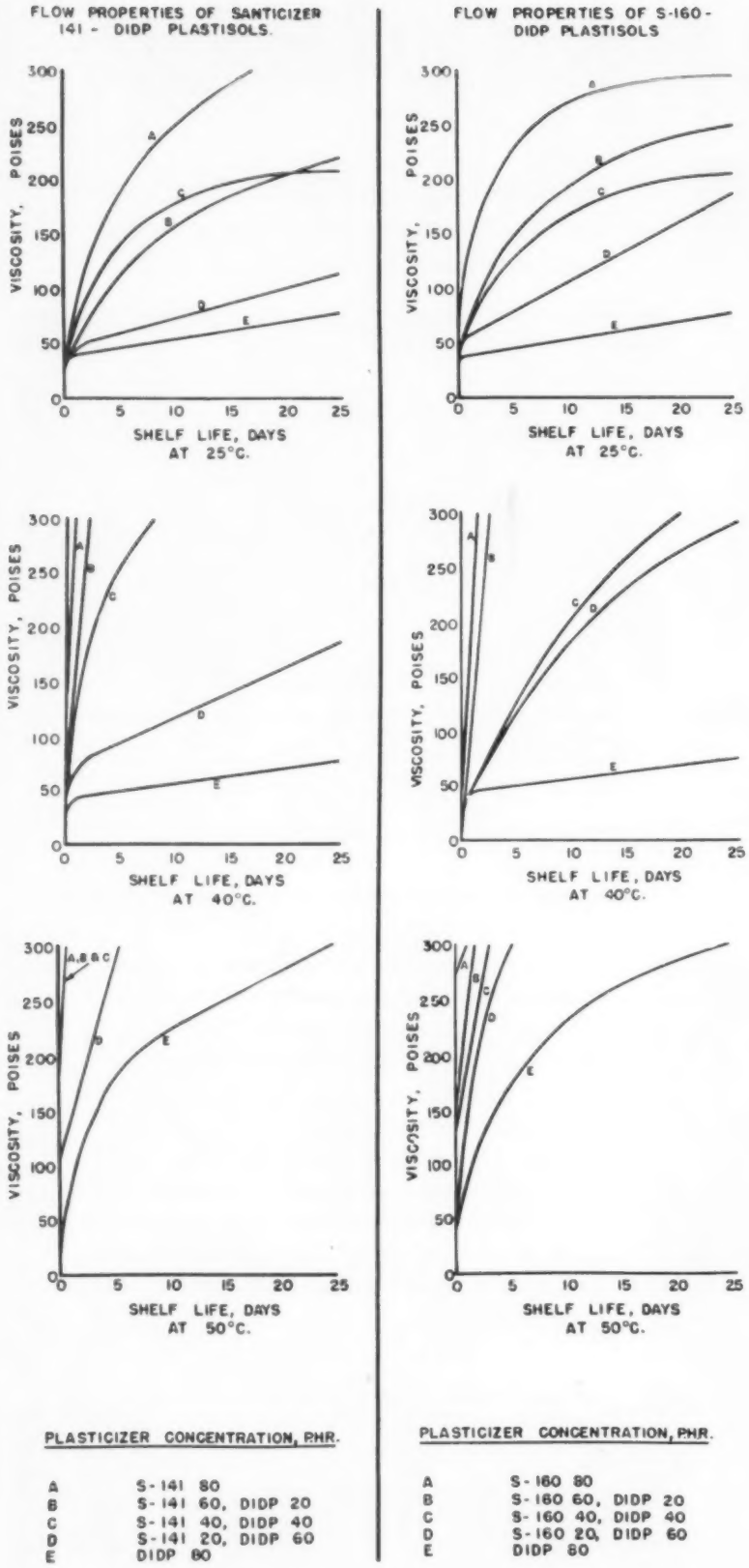

Fig. 5—Viscosity control possible with plastisols containing DIDP in various concentrations with Santicizer 160 and Santicizer 141 plasticizers

DOP and DIDP have comparable viscosity at 25°C. However, at 40°C. the DIDP dispersions are markedly less viscous than the ones with DOP. At 50°C. this effect is even more apparent, with DOP plastisols becoming non-fluid in one day.

As pointed out by Todd (5), the increase in viscosity of filled systems is caused by the absorption of the plasticizer by the filler, thereby leaving less dispersant available for the resin. In filled systems, then, it would be advisable to incorporate a low-viscosity-type plasticizer so as to retain good fluidity at the reduced effective plasticizer concentration caused by the filler. This is further substantiated by the results with DOP- and DIDP-filled plastisols mentioned above. Plotted in Fig. 6 is the viscosity after 1 day at 40°C. versus the Atomite concentration of both DOP and DIDP plastisols. The dispersions prepared from DIDP are considerably lower in viscosity at all concentrations of filler. It is expected that more filler could be added to the plastisol containing the non-solvating-type plasticizer to obtain the same viscosity. This lower viscosity of DIDP plastisols also exist at 25°C., but is less pronounced.

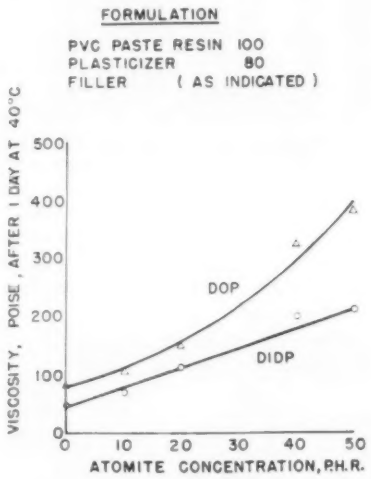

Fig. 6—Effect of Atomite filler concentration on DOP and DIDP plastisols

It was also found that a given plasticizer is not absorbed by various fillers in the same amount, as shown by the results of Gardner-Coleman (5, 6) tests reported in

(To page 250)

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Newark ..... Mitchell 2-0960	"ELASTEX" DCHP Plasticizer
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Effects of Radiation on Polymers

A SYMPOSIUM on the effects of radiation on polymers was held in Cincinnati, Ohio, on April 5 by the Division of Polymer Chemistry of the American Chemical Society under the chairmanship of A. M. Bueche. Abstracts of the papers describing recent work in this rapidly developing field of polymer chemistry are presented here.

Some Fundamental Aspects of the Effects of High-Energy Radiation on Polymers, *by Milton Burton and M. P. Reddy, Dept. of Chemistry, University of Notre Dame.*

In interpreting the effects induced by high-energy radiation on polymers, the principal factors to be considered are: 1) the type of radiation and the characteristic distribution of primary physical processes as to nature and locale; 2) the secondary physical processes including electron diffusion, neutralization, negative ion formation, and ionization and excitation transfer; and 3) the chemical processes as they are modified from normal behavior by high concentration of free radicals and excited molecules and by cage effects characteristic of condensed systems. In general, special *ad hoc* hypotheses to explain seemingly anomalous behavior should be avoided until the applications of presently existing theory have been adequately explored. Characteristic errors that should be avoided are the assumption that effects in a nuclear reactor are similar to those induced by radioactive nuclides and that primary effects are for the most part widely spaced from each other. It appears that an important question is not "why does cross-linking occur," but rather "why does it not always occur?"

Electron Irradiation of Polyacrylates and Polymethyl Methacrylate, *by Allan R. Shultz and Frank A. Bovey, Minnesota Mining and Mfg. Co.*

Films of seven acrylate polymers and polymethyl methacrylate have been irradiated with electrons from a converted 800-kv. resonant transformer X-ray apparatus. Gel content data have been examined according to recent theoretical treatments assuming random cross-linking and main-chain scissioning of polymers having a most probable molecular weight distribution. From these data and the weight-average molecular weights, $\overline{M}_{w,0}$, of the polymers, the energy, E_c, dissipated within each polymer during the formation of a cross-linked unit and the ratio, β/α, of main-chain scissions to cross-linked units formed were calculated.

The energy, $E_d = (\alpha/\beta)\ E_c$, dissipated during the creation of a main-chain scission in methyl, ethyl, and the four isomeric butyl acrylates is a constant (approximately 600 e.v.) within experimental uncertainty. E_c is essentially constant (80 to 100 e.v.) for the methyl, ethyl, *n*-butyl, and isobutyl acrylate polymers. Poly-*tert*-butylacrylate (E_c = 530 e.v.; $\beta/\alpha = 0.7$) differs markedly from the other acrylate polymers studied.

Poly-1, 1-dihydroperfluorobutyl acrylate under electron irradiation yields corrosive fragments which apparently accelerate both degradation and cross-linking.

The energy dissipation, E_d, during an apparent main-chain scission creation in polymethyl methacrylate is 62 electron volts. This is identical to the E_d previously reported for polymethyl methacrylate under Co^{60} gamma irradiation.

Radiation Chemistry of Hydrocarbon Polymers, *by A. A. Miller, E. J. Lawton, and J. S. Balwit, General Electric Research Laboratory.*

When hydrocarbon polymers are subjected to ionizing radiation, the major chemical changes observed are: 1) cross-linking or cleavage of the hydrocarbon chains, 2) production of unsaturation, and 3) evolution of hydrogen and light hydrocarbons.

The results of the high-energy (800 kvp.) electron irradiation of polyethylene, polymethylene, octacosane, polypropylene, and polyisobutylene are presented. Of this series, only polyisobutylene undergoes degradation in molecular weight; in the remainder, an increase in molecular weight—i.e., cross-linking—is the predominant process.

Measurements of molecular weight changes, infra-red absorption analyses for the several types of unsaturation formed (vinyl, vinylene, and vinylidene), and mass spectrometric analyses of the evolved gases have been made for the irradiation of these hydrocarbon polymers. The results are related to the molecular weight and chemical structure, particularly with respect to branching, of the hydrocarbon polymer.

Effects of Radiation on Organopolysiloxanes, *by E. L. Warrick, Mellon Institute.*

The effects of four types of high-energy radiations have been noted on dimethylpolysiloxane elastomers. These sources were cyclotron, cobalt-60, X-ray target, and Van de Graaff electron accelerator. Cross-linking efficiencies with 2-m.e.v. electrons were slightly less than one link per ion pair. Polysiloxanes containing large amounts of phenyl substituent proved to be resistant to radiation. In one instance more than 200 Mrep exposure did not establish sufficient cross-links to insolubilize a high-molecular-weight polymer. Physical property studies of radiated samples of silicone rubber show the advantages of this type of cure to lie in its control and its freedom from residue effects that are normally present with organic vulcanizing agents.

Chemical Activity of Polymethyl Methacrylate Previously Exposed to γ-Radiation, *by L. A. Wall and D. W. Brown, National Bureau of Standards.*

Recently it has been demonstrated that free radicals or atoms, when produced in frozen hydrocarbons or monomers at about 90° K., can be immobilized and stored for extended periods of time, their existence in significant quantities being demonstrated either spectrometrically or by polymer formation. It would appear probable that solid polymers at room temperature, after exposure to high-energy radiation, are also likely to contain active

(*To page* 252)

PLASTICS DIGEST*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. For complete articles, send requests direct to publishers. List of addresses is at the end of Plastics Digest.

Materials

SINTERED NYLON PLASTICS. K. G. Harms. Product Eng. *25*, 150-53 (Nov. 1954). The properties and applications of a new group of materials, sintered nylon plastics, are described. Sintered nylon is cold-pressed molding powder fabricated by techniques similar to those used in the powder metallurgy field; a finished part is automatically stress relieved by the nature of the process. The properties are still further improved by heating the cold-pressed articles at temperatures somewhat below their melting points or normal molding temperatures. Although sintered nylon does not have the high strength of powdered metals, it is often superior in corrosion resistance, in lightness of weight, and in abrasion resistance under light loads and low speeds. The powdered metal fabrication technique permits the combination of nylon with other materials to give blended materials having many desirable properties. The design requirements for sintered nylon parts are discussed.

FOAM KING PROCESS OF PRODUCING FOAM PLASTICS. Rubber Age 75, 395 (June 1954). Two new processes for the formulation and manufacture of foam plastics are reported. One, for the production of open cell foam, utilizes a plastisol which, when poured into the mold, rises to a predetermined height and density by the application of low-temperature heat. The other process produces, also by chemical means, closed cell foam containing nitrogen-filled sealed cells.

REINFORCED ACRYLATE ELASTOMERS CAST FROM LATEX. P. Fram, A. J. Szlachtun, M. G. DeFries, and F. Leonard. Ind. Eng. Chem. *46*, 1992-2000 (Sept. 1954). Various acrylate elastomers were emulsion polymerized and compounded by direct latex reinforcement. Films cast from these latices retained their translucent optical quality as a result of a judicious choice of fillers. The strength properties were significantly improved by copolymerization with increased amounts of acrylonitrile and by loading with finely divided, noncarbon-type fillers. By the proper combination of the base elastometric copolymer and the loading volume of the reinforcing agent, elastomers with a wide range of physical properties were developed.

POLYMERIC PLASTICIZERS. G. R. Kloos. Kunststoffe *44*, 429-30 (Oct. 1954). The shortcomings of the well-known monomeric esters used as plasticizers for polyvinyl chloride plastics led to the investigation of polyesters of higher molecular weight made by reacting saturated bifunctional fatty acids with glycols. The most common acids used are adipic, azelaic, and sebacic acids because they are commercially available. These plasticizers have several advantages over the monomeric esters, especially better resistance to extraction by solvents, fats, and oils, better resistance to migration, and decreased volatility. Although these plasticizers are called "polyester plasticizers" they should not be mistaken for the chemically different unsaturated polyester resins.

SILICONE MOLDING RESINS. H. N. Homeyer, J. H. Preston, S. Casapulla, and E. M. Beekman. Ind. Eng. Chem. *46*, 2349-54 (Nov. 1954). Recent aircraft and communications developments have resulted in operating conditions too severe for organic molded electrical insulating parts. An evaluation of silicone molding compounds for Army-Navy electrical connector inserts has shown that new type compounds have been developed that prevent insulation failure from very high humidity, very high temperature, and electrical arcing. Their physical strength is equal to that of organic types. They can be readily molded with the short cycles and simple techniques used for phenolic compounds and long postmold cures, formerly required, have been eliminated.

Molding and Fabricating

ACCEPTANCE TESTS IN THE PLASTICS INDUSTRY. H. Mertz, Kunststoffe *44*, 374-77 (Sept. 1954). Statistical methods used in America but mostly unknown in Germany, applied to insure greater reliability of acceptance tests between manufacturer and processor, are discussed. The practical example of evaluating residual shrinkage of plastic films is chosen to demonstrate the fundamental principles of the method.

AUTOMATIC PRODUCTION EQUIPMENT FOR RESIN MIXES. M. Schneider. SPE J. *10*, 21-28 (Sept. 1954). Automatic processing equipment is described that continuously de-aerates, proportionally meters, mixes, and meter dispenses multi-component resins and elastomers. It does this under closely controlled temperatures, with resins in a wide range of viscosity and pot life, including the hot-melt types. The equipment can be used for laminating, mat molding, and matched die molding; plastic tooling, adhesives, and sealers; potting, casting, and embedment; protective, decorative, and sealant coating; thermosetting extrusion; and rigid and flexible chemically-foamed plastics. Once the equipment has been set up and placed in use, only one operator is required for the entire process. A schematic flow diagram is given of the equipment and controls.

Applications

RESEARCH PROGRESS IN DIELECTRICS —1954. A. E. Javitz. Elec. Mfg. *54*, 70-78, 296, 298 (Dec. 1954). The highlights of the 1954 Conference on Electrical Insulation are summarized and interpreted. Problems of deterioration and breakdown of dielectric materials receive particular emphasis. The silicones are revealed as outstanding materials for insulating applications. Silicone glass-fiber insulation satisfactorily withstood heat aging for 48 hr. at 350° C. and humidification at 90% relative humidity for 24 hr. at room temperature as evidenced by good retention of mechanical properties, dielectric

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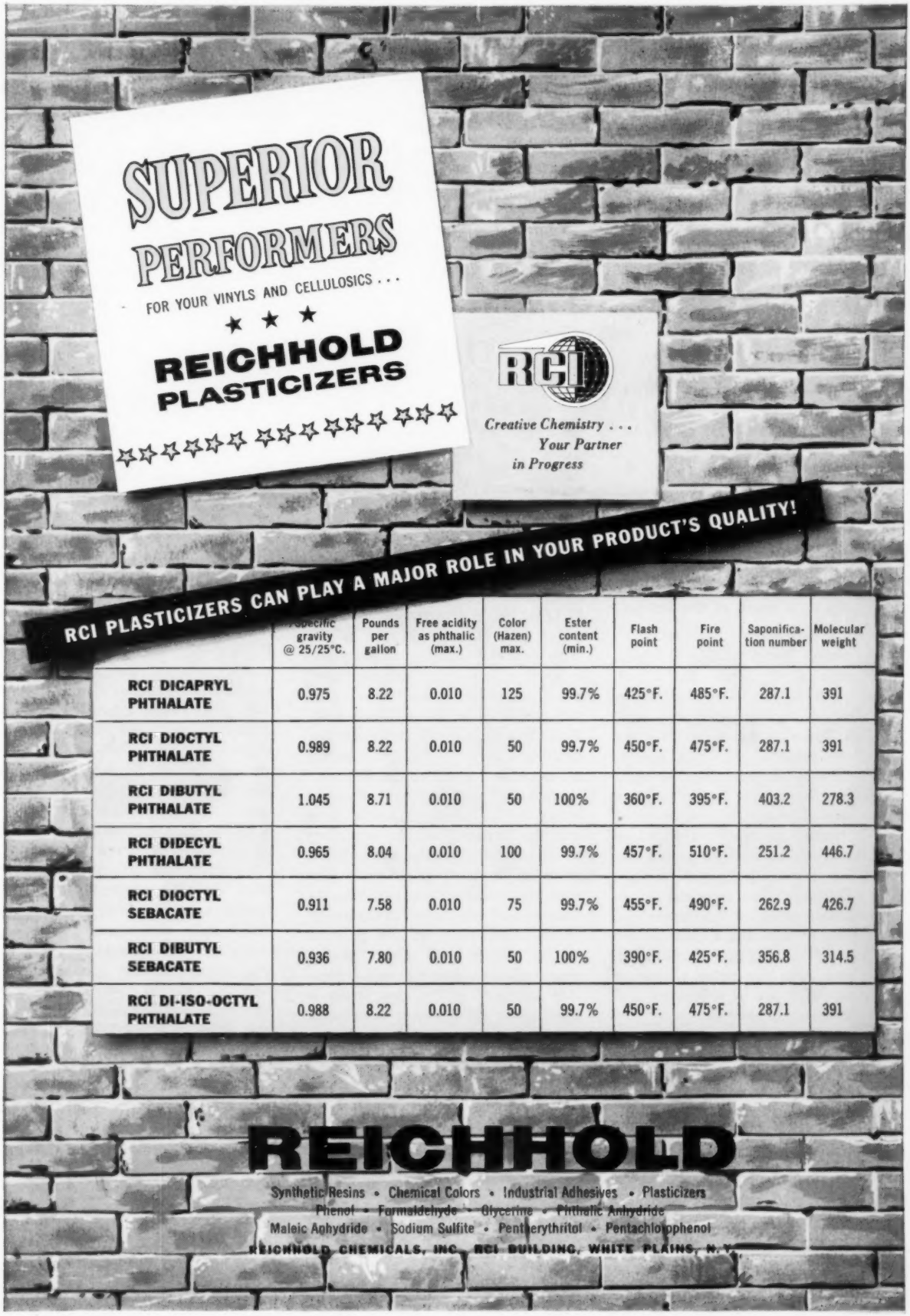

	Specific gravity @ 25/25°C.	Pounds per gallon	Free acidity as phthalic (max.)	Color (Hazen) max.	Ester content (min.)	Flash point	Fire point	Saponification number	Molecular weight
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RCI DIOCTYL PHTHALATE	0.989	8.22	0.010	50	99.7%	450°F.	475°F.	287.1	391
RCI DIBUTYL PHTHALATE	1.045	8.71	0.010	50	100%	360°F.	395°F.	403.2	278.3
RCI DIDECYL PHTHALATE	0.965	8.04	0.010	100	99.7%	457°F.	510°F.	251.2	446.7
RCI DIOCTYL SEBACATE	0.911	7.58	0.010	75	99.7%	455°F.	490°F.	262.9	426.7
RCI DIBUTYL SEBACATE	0.936	7.80	0.010	50	100%	390°F.	425°F.	356.8	314.5
RCI DI-ISO-OCTYL PHTHALATE	0.988	8.22	0.010	50	99.7%	450°F.	475°F.	287.1	391

strength, and water repellency and by practically unchanged power factor. "Alloys" of silicone resins with a styrene copolymer possess better surface insulation when wet and dirty than Teflon. A heat-reactive silicone rubber that flows under its own weight makes possible the close following of the configuration of units being encapsulated. Silicone rubber materials that cure at room temperature are now available; they are supplied as two-part systems, each containing a catalyst, which vulcanize upon mixing without the need for heat or pressure. The dielectric behavior of various gaseous and liquid materials is discussed. The problem of dielectric failure due to silver migration through the insulator is reviewed. New instruments for dielectric measurements are described briefly. The effects of high-energy radiation on dielectrics are noted; in one group of studies, polystyrene withstood radiation better than fluorocarbons and other plastics as evidenced by lower changes in conductivity as a result of the irradiation.

ADHESIVE BONDING. H. Thielsch. Materials & Methods *40*, 113-28 (Nov. 1954). The field of adhesive bonding is comprehensively surveyed. Types of adhesives, bonding methods, solvents, modifying agents, and criteria for selecting the right adhesive for specific applications are discussed. The text is supplemented with numerous charts and tables that summarize the typical characteristics of each of the various types of adhesives, give information on production variables, list commercial practices in selecting adhesives and factors influencing their formulation and use, give the price ranges of commercial types of adhesives, and list commercial sources.

Properties

DYNAMIC CHARACTERISTICS OF SILICONE RUBBER. G. W. Painter. Trans. A.S.M.E. *76*, 1131-35 (Oct. 1954). The unusual high- and low-temperature properties of silicone rubber have made it a desirable material for vibration isolators designed for service at extremes of temperature. However, the silicones are not directly interchangeable with elastomers such as natural rubber and neoprene in established designs, largely because of the lower tensile strength and the unusual load-deflection characteristics of the silicone materials. In order to provide the design engineer with information that would allow the material to be utilized properly, a program to investigate the dynamic properties of silicone rubber was carried out. A dynamic modulus-testing machine of versatile and efficient operation is described. The viscoelastic properties of silicone rubber are compared with those of natural rubber at various conditions of strain, temperature, and frequency. The excellent low-temperature properties of silicone rubber provide the vibration-isolator designer with a material that will function properly at —100° F. Although the modulus of silicone rubber is more greatly affected by static strain than is natural rubber, this characteristic can be provided for in the design.

INVESTIGATION OF UNUSUAL ORIENTATION IN POLYETHYLENE BY INFRA-RED SPECTROSCOPY. A. Keller and I. Sandeman. J. Polymer Sci. *15*, 133-50 (Jan. 1955). A quantitative analysis of the 725 cm.$^{-1}$ doublet in the infra-red spectrum of polyethylene is given and used to check the "row" model of polyethylene, as it naturally crystallizes from drawn melt. This analysis depends on a new interpretation of the 725 cm.$^{-1}$ doublet, according to which the 730 cm.$^{-1}$ component has its transition moment along the *a* crystallographic axis, and the 720 cm.$^{-1}$ component along the *b* axis. The amorphous polymer gives only a band at 720 cm.$^{-1}$. The analysis in certain cases enables the amount and orientation of the amorphous component of the polymer to be determined. From similar considerations, variation in the relative intensity of the two peaks in the course of drawing unoriented polyethylene are explained.

CREEP-TIME RELATIONS FOR NYLON IN TENSION, COMPRESSION, BENDING, AND TORSION. J. Marin, A. C. Webber, and G. F. Weissmann. Proc. A.S.T.M. *54*, (1954). The results of an investigation dealing primarily with the creep deformation-time relations of nylon FM 10001 and nylon FM 3001 under various types of stress are reported. The stresses considered include tension, compression, pure bending, and pure torsion. For each of these stresses the influence of the stress magnitude upon the creep-time relations was investigated. To determine whether creep deformation-time relations for torsion and bending could be predicted on the basis of the tension and compression creep-time relations, theoretical relations for torsion and bending creep were developed. These relations were based upon empirical equations defining creep deformation-time variations in tension and compression. A comparison of actual values showed good agreement between them. Special creep tests were also made to evaluate the extent of creep recovery resulting on the removal of stress. It was found that a large part of the total creep strain was recovered on load removal. A series of tests was also conducted to determine the influence of rest periods upon the creep-stress-time relations. A small amount of creep recovery was found to occur during overnight rest periods between "cycling" tests.

FRICTION AND LUBRICATION OF NYLON. R. C. Bowers, W. C. Clinton, and W. A. Zisman. Ind. Eng. Chem. *46*, 2416-19 (Nov. 1954). Static and kinetic friction for steel against nylon and for nylon against nylon, both dry and lubricated, were studied using "stick-slip" apparatus at 25° C. The friction of nylon against nylon is appreciably higher than steel against nylon. Lubrication of the nylon-nylon combination is much more difficult because it is more difficult to form a close-packed lubricating film on nylon than on steel, since the adsorption sites are farther apart. Perfluorinated paraffins and derivatives increased boundary friction. Aliphatic acids and primary amines decreased friction of nylon by hydrogen bonding to the amide groups. Liquids suitable to serve as a lubricant base for nylon include mineral oils, esters, silicones, and halogenated hydrocarbons, and the best additives are the long-chain fatty acids and primary amines.

FLOW PROPERTIES OF VINYL CHLORIDE RESIN PLASTISOLS. E. T. Severs and J. M. Austin. Ind. Eng. Chem. *46*, 2369-75 (Nov. 1954). Methods and equipment used to clarify the problem of defining the flow characteristics of non-Newtonian materials, in the form of vinyl chloride

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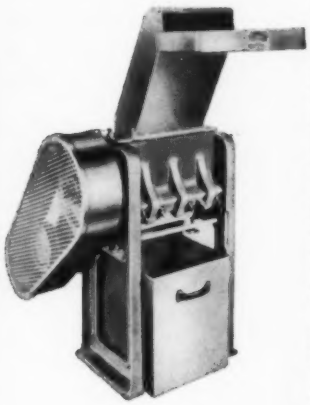

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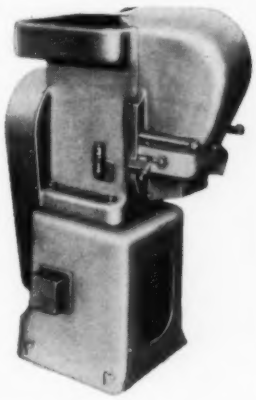

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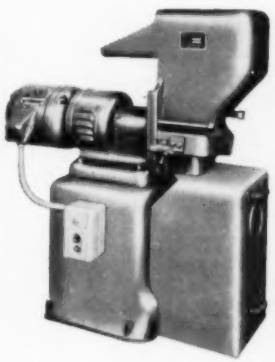

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resin plastisols, are described. The flow properties of the plastisols are defined by means of an extrusion rheometer designed for the purpose. The apparent viscosity of a typical plastisol remains constant when the orifices of an extrusion rheometer are changed to vary the ratio of length to diameter from 7.9 to 31.8. Flow curves obtained using an extrusion rheometer correlate with flow curves obtained from a modified Martinson coater. Dilatancy of the resin dispersion appears to be important only when most of the fluid film thickness is involved. The effect of a number of plasticizers on the flow properties of plastisols was investigated and the effects of chemical structure of plasticizers is discussed. The concentration of the plasticizer is shown to have a more pronounced effect on the flow properties of highly solvated plastisols than on normal plastisols.

Testing

DETECTION AND ESTIMATION OF MELAMINE IN WET-STRENGTH PAPER BY ULTRA-VIOLET SPECTROPHOTOMETRY. R. C. Hirt, F. T. King, and R. G. Schmitt. Analytical Chem. *26*, 1273-74 (Aug 1954). The use of melamine resins to impart wet strength to paper makes desirable a rapid method for the detection and estimation of the melamine content of paper samples. A spectrophotometric method was developed which makes use of the strong absorption of the melamine ion at 235 mμ. The resin is effectively extracted from the paper and hydrolyzed to melamine by refluxing cut-up paper samples in 0.1N hydrochloric acid.

MEASURING VOLUME SHRINKAGE OF RESINOUS MORTARS. L. H. Brown and E. A. Reineck. ASTM Bulletin No. 205, 67-68 (Apr. 1955). A method which measures total shrinkage of resinous mortars as they pass from the trowelable form to the fully cured state is described. It may be useful in predicting the maximum shrinkage of resinous mortars under actual service conditions.

PRODUCTION TESTING OF BONDED MATERIALS WITH ULTRASONICS. G. B. Baumeister. ASTM Bulletin No. 204, 50-53 (Feb. 1955). Production processes involving bonded materials can be controlled by suitable application of modern ultrasonic inspection procedures. Variations in

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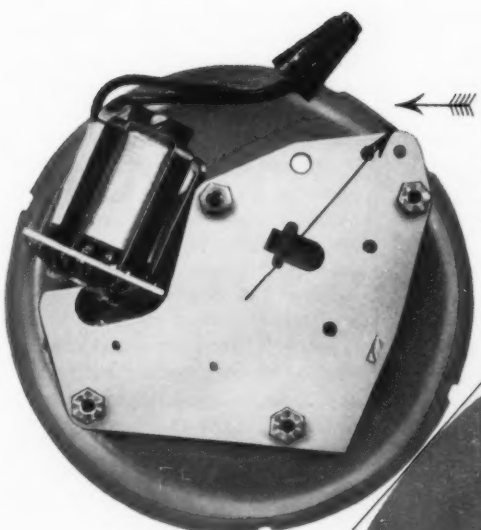

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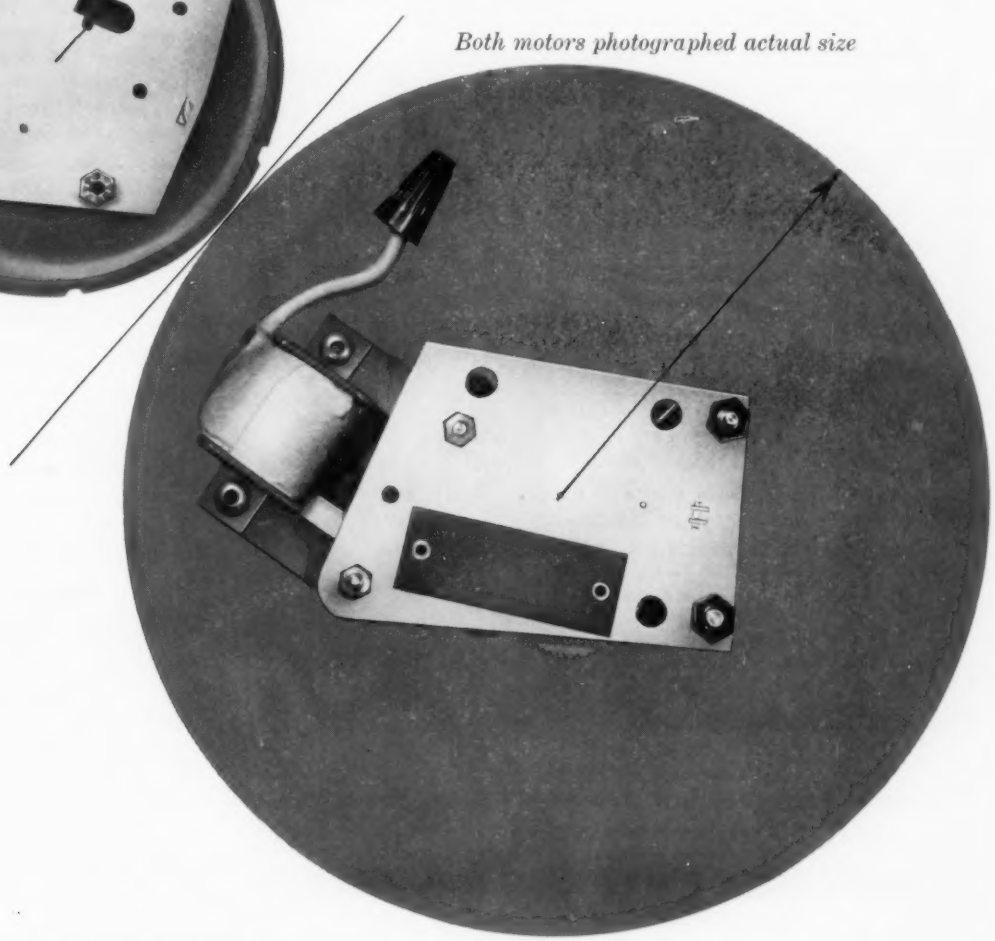

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transducer area and operating frequency range permit the detection of extremely small unbonded areas. The type of indications obtained are very easy to interpret; relatively little or no training is necessary under most conditions. Ultrasonic inspection and quality control applications make it possible to use a wide range of new materials and processes, resulting in lower costs to both the manufacturer and the consumer.

MEASURING VISCOSITY OF THERMOSETTING RESINS BY PARALLEL PLATE PLASTOMETRY. D. I. Marshall. ASTM Bulletin No. 204, 40-44 (Feb. 1955). The parallel plate plastometer was found to be useful for measuring viscosity at various temperatures and viscosity changes during thermal hardening of various types of thermosetting resins. Rapid temperature equilibrium, fast viscosity reading, and lack of a cleaning problem make it particularly suitable for thermosetting type substances. The viscosity-time test is applicable to two-stage and resol types of phenol-formaldehyde resins and to polysiloxane resins. It is applicable in some degree to epoxy resins and spray-dried urea-formaldehyde resins but is not applicable to the melamine-formaldehyde molding resins. It should be applicable to other thermosetting products where departure from Newtonian flow is small and foaming is not severe. Viscosity data and parameters obtained from viscosity-time curves are useful as indications of rheological changes caused by polymerization and cross-linking during fabrication with thermosetting resins in molding material and bonding applications.

Publishers' Addresses

Analytical Chemistry: American Chemical Society, 1115 Sixteenth St., N. W. Washington 6, D. C.
ASTM Bulletin: American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.
Electrical Manufacturing: The Gage Publishing Co., 1250 Sixth Ave., New York, N. Y.
Industrial and Engineering Chemistry: American Chemical Society, 1115 Sixteenth St., N. W. Washington 6, D. C.
Journal of Polymer Science: Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y.
Kunststoffe: Carl Hanser Verlag, Leonhard-Eck-Strasse 7, Munich 27, Germany.
Materials and Methods: Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y.
Proceedings of the A.S.T.M.: American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.
Product Engineering: McGraw-Hill Publishing Co., 330 W. 42nd St., New York 18, N. Y.
Rubber Age: R. T. Vanderbilt Co., Inc., 230 Park Ave., New York 17, N. Y.
SPE Journal: Society of Plastics Engineers, 513 Security Bank Bldg., Athens, Ohio.
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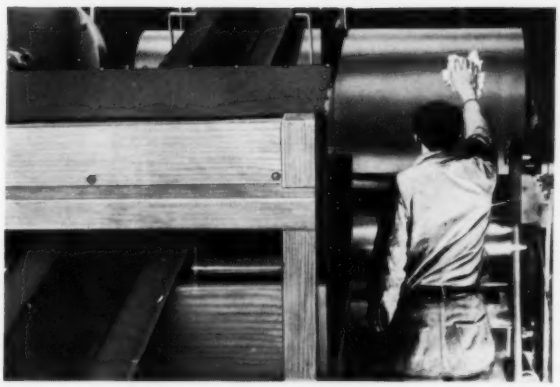

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U. S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each.

POLYSTYRENE. E. H. Wood and J. R. Wilkinson (to Carbide and Carbon). U. S. 2,701,241, Feb. 1. Stabilization of polystyrene with 2,4-dinitrophenyl hydrazine.

POLYMERIZATION. M. Erchak, Jr., K. F. Koch, and H. Knutson (to Allied Chemical). U. S. 2,701,242, Feb. 1. Low temperature polymerization with potassium permanganate and oxalic acid.

POLYMERIZATION. W. Lynn (to Eastman Kodak). U. S. 2,701,245, Feb. 1. Bead polymerization of methyl methacrylate.

DRYING. J. F. Yost and I. B. Frederick (to American Cyanamid). U. S. 2,701,391, Feb. 8. Drying polyacrylates.

TUBE. T. H. Gewecke (to Baxter Laboratories). U. S. 2,701,565, Feb. 8. Distending plastic tube.

INSULATION. N. F. Arone (to General Electric). U. S. 2,701,776, Feb. 8. Polyvinyl chloride insulation.

DRYING OILS. J. F. Nelson, J. F. McKay, Jr., L. M. Welch, and D. F. Koenecke (to Standard Oil). U. S. 2,701,780, Feb. 8. Heat-curing synthetic drying oils.

CUTTING TOOL. N. Anton, U. S. 2,701,835, Feb. 8. Electrically heated thermal cutting tool for cutting plastic sheet.

PANELS. H. J. Hammerly, R. T. Casey, and W. H. Yeamans (to General Electric). U. S. 2,701,894, Feb. 15. Method for forming plastic panel units.

TUBING. C. E. Hayward and E. S. Gorton (to Bemis Bag). U. S. 2,701,989, Feb. 15. Forming tubing from a plastic coated web.

SURFACE TREATMENT. L. L. Yaeger (to American Motors). U. S. 2,702,255, Feb. 15. Treating polystyrene with mixed cellulose esters.

POLYSILOXANES. L. Q. Green (to Du Pont). U. S. 2,702,276, Feb. 15. Water dispersible polysiloxane emulsions.

EXTRUSION. D. Hartland (to Carbide and Carbon). U. S. 2,702,408, Feb. 22. Device for extrusion of thermoplastics.

EXTRUSION. D. G. Loomis. U. S. 2,702,409, Feb. 22. Extrusion press.

EXTRUSION. G. S. Brown (to Western Electric). U. S. 2,702,410, Feb. 22. Working and extruding plastics.

EMBOSSING. T. W. Winstead. U. S. 2,702,411, Feb. 22. Forming and embossing thermoplastics.

LAMINATE. A. W. Bateman (to Du Pont). U. S. 2,702,580, Feb. 22. Metallic finish laminated plastic sheet.

RESIN. T. V. S. Rao and N. Desikachar (to Tata Oil). U. S. 2,702,754, Feb. 22. Protein, ligno-cellulose, fatty oil resin.

BATTERY SEPARATOR. E. C. Uhlig and L. A. Murray, Jr. (to U. S. Rubber). U. S. 2,702,758, Feb. 22. Cellulosic sheet impregnated with phenolic resin.

INSULATION BOARD. C. P. Mannheim (to Celotex). U. S. 2,702,761, Feb. 22. Plastic-impregnated fiberboard.

FABRIC. E. V. Painter and L. D. Frisoli (to Fabric Research). U. S. 2,702,764, Feb. 22. Nylon fabric coated with a resin.

BONDING. W. S. Penn and E. R. Thornley (to Henly's Tyre and Rubber). U. S. 2,702,773, Feb. 22. Bonding rubber to plastic sheet with a polyisocyanate adhesive.

ION EXCHANGE. M. E. Gilwood (to Permutit). U. S. 2,702,795, Feb. 22. Anion-exchange resin.

TEXTILE SIZE. R. D. Fine, III (to Atlas Powder). U. S. 2,702,796, Feb. 22. Polymethacrylic acid size.

WRAPPING. H. R. Denton. U. S. 2,702,972, Mar. 1. Machine for wrapping articles with thermoplastic film.

PRINTING PLATES. H. M. Richardson (to News Syndicate). U. S. 2,703,051, Mar. 1. Plastic printing plates.

PACKAGE. L. Peters. U. S. 2,703,287, Mar. 1. Food package.

COATINGS. C. J. Guillissen and A. Gancberg (to Union Chimique Belge). U. S. 2,703,294, Mar. 1. Organic polysiloxane coatings.

ROPE SPLICE. A. W. Koon (to Columbian Rope). U. S. 2,703,300, Mar. 1. Plastic covered rope splice.

POLYMERS. A. K. Schneider (to Du Pont). U. S. 2,703,316, Mar. 1. Polymers of high-melting lactide.

POLYMERS. G. F. D'Alelio (to Koppers). U. S. 2,703,317, Mar. 1. Polymers of N-(2-pyridyl)-beta-cyanoacrylamides.

EXTRUSION. J. Allan and D. W. Browne (to British Celanese). U. S. 2,703,434, Mar. 8. Die-head for hot extrusion.

MOLDING. J. E. Watson (to Dentist's Supply). U. S. 2,703,435, Mar. 8. Molding artificial teeth.

AMMUNITION LINER. A. J. Tuckerman, A. Gallaccio, and M. Kushner. U. S. 2,703,529, Mar. 8. Lining for perforated cartridge cases.

MOLDING. C. W. Yogt. U. S. 2,703,537, Mar. 8. Forming plastic materials.

HYPODERMIC. R. Chibret, E. Petavy, and G. Bonnevay. U. S. 2,703,575, Mar. 8. Plastic hypodermic.

SHEET CUTTING. N. H. Nye, R. W. Penn, C. C. Ensinger, and C. H. Sorrick, Jr. U. S. 2,703,612, Mar. 8. Apparatus for cutting plastic film.

COMPOSITION. S. F. Marrian and W. H. Thompson (to Imperial Chemical). U. S. 2,703,763, Mar. 8. Solution of cellulose nitrate and triallylpentaerythritol ethyl carbonate.

TAPE. C. W. Vogt. U. S. 2,703,764, Mar. 8. Adhesive plastic film tape.

COATING. L. K. Osdal (to Du Pont). U. S. 2,703,765, Mar. 8. Epoxy coating composition.

INFLATABLE STRUCTURE. J. Melzer. U. S. 2,703,770, Mar. 8. Inflatable plastic structure.

REFLECTOR. J. C. Stimson (to Elastic Stop Nut). U. S. 2,703,773, Mar. 8. Plastic reflector units.

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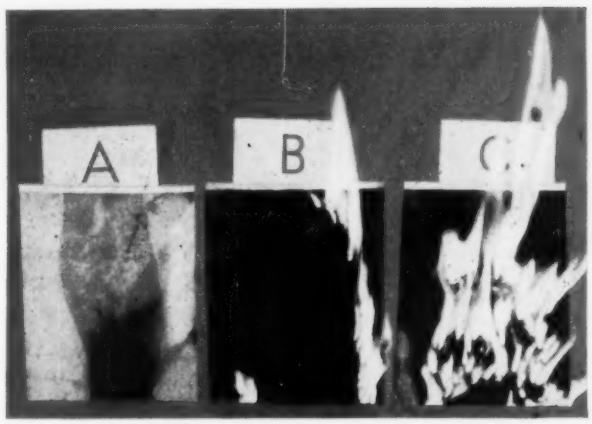

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Gel Tester—The Castor Gelometer for automatic determination of gelation time or stability of polyesters and phenolics in research, quality control, or production, is a self-contained unit claimed to be suitable for conducting the S.P.I. gel test for polyester resins. The unit contains an oscillator, sensitive from 5000 to 50,000 cp., which automatically stops a timer when a desired viscosity is reached. A constant-temperature bath ranges from ambient temperature to 212°F. Once set up for a test, the equipment runs to completion without further attention from operator. Readings can be taken at any time.

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DEPENDABILITY— Because of all-steel construction and Van Dorn's established reputation in the plastics machinery field.

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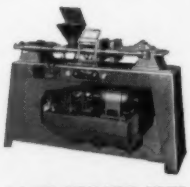
2687 East 79th Street • Cleveland 4, Ohio
Cable Address: "VANDORN" Cleveland

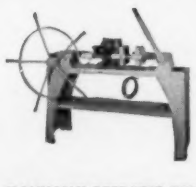
and this Van Dorn model is the lowest priced press in its class!

WRITE FOR COMPLETE DATA ON MODEL H-250 AND OTHER EQUIPMENT SHOWN

SEMI-AUTOMATIC PRESS
2-oz. capacity.

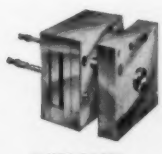


POWER OPERATED, LEVER CONTROLLED PRESSES
2-oz. and 1-oz. models

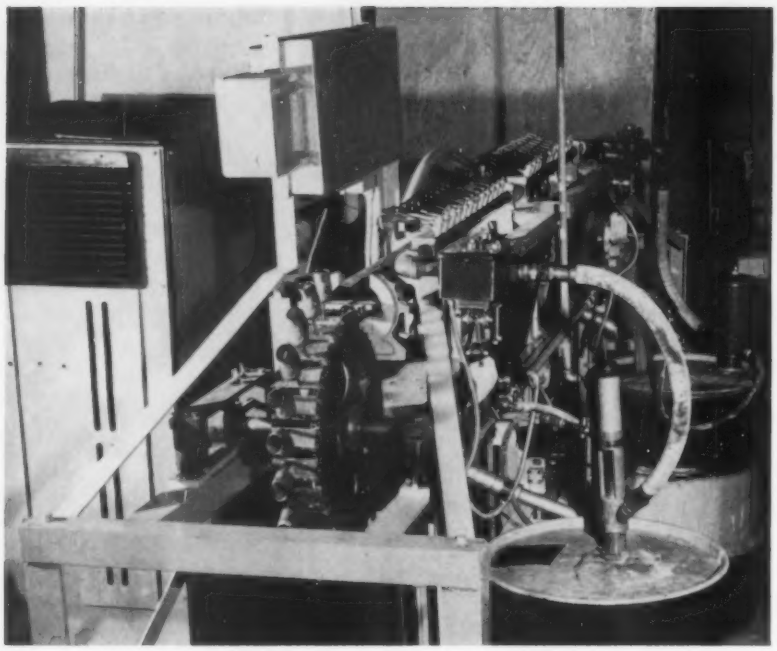


MANUALLY OPERATED PRESS
1-oz. For small jobs, training, etc.

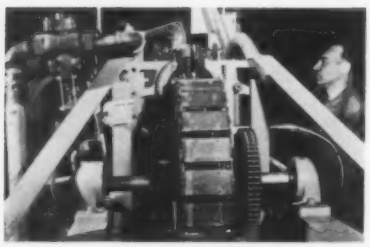
PLASTIC GRINDER
Grinds up rejects, waste, etc., for re-use.



MOLD BASES
Available from stock.



Electronic Mold's automatic slush molding machine, set up to mold doll shoes

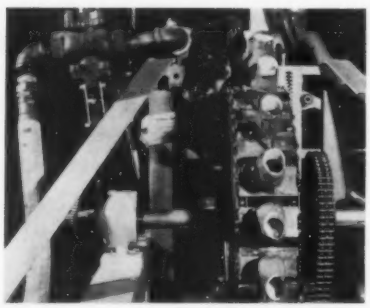


Close-up of slush molding unit, with molds at station number 2 being filled with metered quantity of plastisol

quency induction heating for plastisol cure. The unit includes six stations and operates as follows:

At the first station, which has provision for vibrating the molds, if required, the molds are filled and dumped. (In the accompanying illustrations, molds are mounted in units of twelve.) This filling operation produces a wipe coat of plastisol in the molds and serves to reduce entrapped air to a minimum. Plastisol stored in drums alongside the machine is pumped directly into the mold shells, the correct amount being controlled by a metering device. When molds are dumped, excess plastisol flows back into the drum from which it was originally pumped. (See top photo.)

Following the first fill-and-dump operation, the group of molds is indexed to station 2, where the molds are again filled. Now the induction heater is automatically actuated until a gel of the required thickness and partial cure is reached. At this point, the molds dump the excess plastisol and index to station 3, where the heat still being held by the mold shells fully cures the plastisol skin. Cooling is accomplished at station 4 with a continuous low-pressure air blast for the period of dwell at this station. Following the dwell period, molds advance to station 5 where the operator manually strips the finished parts from the shells. Station 6 is an idle station where mold shells can be mounted on the indexing units. *Electronic Mold Corp., 1055 North Drive, East Meadow, Long Island, N. Y.*



Molds being indexed to station number 3 for final cure of plastisol; new set of molds has moved into station 2

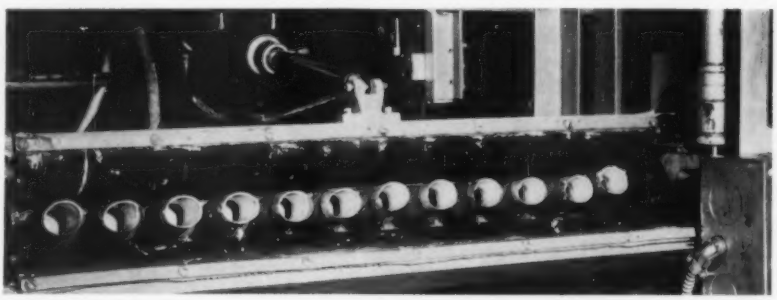
Cylinder Speed Control—Modification of Speed King main control valves provides speed control of cylinders, important in the field of automation.

Conventionally, two valves are required to control cylinder speed in both directions. The modified valve accomplishes restriction of flow through the main control valve, eliminating the need of separate flow control valves. For valves already in service, conversion kits are available. Speed King valves with built-in speed control and conversion kits are offered for four-way foot-mounted, and sub-base-mounted, single- and double-solenoid valves in sizes of ¼, ⅜, ½, ¾, and 1 inch. *Valvair Corp., 454 Morgan Ave., Akron 11, Ohio.*

Paint Wiper—Completely air operated, a new automatic paint wiper for removing excess paint from part surfaces while leaving it in depressed numbers, letters, graduations, etc., can handle between 800 and 1200 pieces per hour. The basic machine rotates the part to be wiped against a towel.

In use, the operator places the painted part on a holding fixture and

View of station number 5; plastisol is fully cured, ready to be stripped from molds



For long-lasting whiteness, specify easily dispersible

UNITANE® OR-342

RUTILE TITANIUM DIOXIDE

Whiteness, brightness and opacity, stability to heat and light, freedom from hard-to-disperse clusters—all of these combine to make UNITANE OR-342 rutile titanium dioxide the white pigment choice in high-quality plastics.

UNITANE OR-342 is carefully processed and check-tested to maintain soft texture and easy dispersion—a quality you must have for perfect polyvinyl sheeting; a quality that means economy in all plastics compounding.

depresses a foot pedal. The part moves upward with a spinning motion, engages the towel, and then pushes against a mandrel built especially to fit the wiped surface. This action wipes the paint from the surface, leaving it in the depressed areas molded into the piece. After each stroke of the machine, the towel indexes to a clean spot.

To accommodate parts that cannot be spun without tearing the towel, two attachments are available. One is an oscillating unit, for use on such items as dials that have finger grips; the other is of the reciprocating type and rubs the piece back and forth against the towel (e.g. to wipe gradations on a three-cornered ruler).

Wiping towels are re-usable after washing; in some cases disposable paper towels can be used. *Finish Engineering Co., Inc., 1115 Cherry St., Erie, Pa.*

Injection Machine—Model 1200-H-80 is a semi-automatic 80-oz. injection molding machine with a mold mounting area of 60 by 48 in., a 36-in. mold clamp stroke for the production of deep parts, and an injection speed of 2850 cu. in. of material per minute. Automatic weigh feeder of the compensating type is standard equipment.

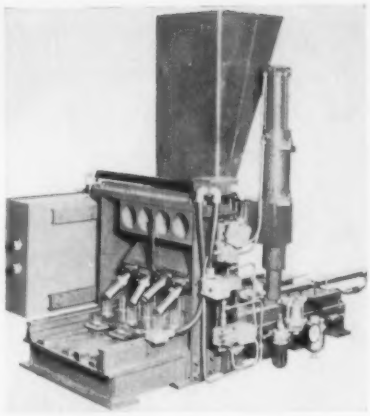
A straight-line, fully hydraulic mold clamp provides fast closing and opening speeds, with automatic slow-down prior to mold contact, at mold breakaway, and during ejection of molded part. Full mold clamp capacity is 1200 tons.

Plasticizing capacity of the machine for polystyrene is 400 lb./hour. Plasticizing chamber has three pyrometer-controlled heat zones. Heating bands are mounted directly on spreader. The injection unit, hydraulically retractable, is mounted on ways, and actuated by a single hydraulic cylinder. Injection nozzle is hydraulically loaded, and a positive, hydraulically operated sprue break can be used at operator's option. A large-diameter plunger is said to make the machine especially useful for molding polyethylene.

Model 1200-H-80 is operated by a 100-hp. electric motor. The power system is mounted in the open for accessibility. *The Hydraulic Press Mfg. Co., Mount Gilead, Ohio.*

Inserts—Standardized aluminum inserts for molded plastics have holes tapped to maximum depth for over-all length with Class II threads (to meet A.S.M.E. specifications) in sizes from 4-36 to 12-24. Holes are reamed after tapping for close tolerances and to facilitate securing the inserts on the locating pins. Outside knurl is coarse, to provide holding power against high torque. *The Yardley Precision Products Co., 20 E. Afton Ave., Yardley, Pa.*

Loading Board—For use with Baker 12-, 25-, 50-, 75-, and 100-ton automatic presses, loading board is supplied blank and can be drilled to suit any mold combination. For example, a board for feeding 12 cavities can be drilled with four rows of three holes each. After the first row is fed by the power feeder, the board indexes forward automatically to position the next row for feeding, etc. The board is cycled with the press to load the mold cavities during curing time. It is air-actuated and interlocked with the press. *Baker Brothers, Inc., Box 101, Station F, Toledo, Ohio.*

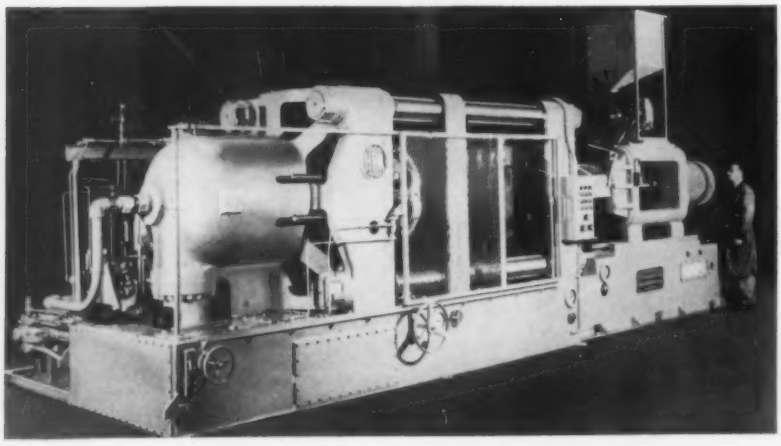


Baker Brothers' loading board is supplied blank, can be drilled for any number of cavities (12 in the illustration above)

Vacuum Forming Machine—Model 88 is a small, inexpensive vacuum forming machine that stands 54 in. high, occupies a floor space area of only 28 by 59 in., and weighs 300 pounds. It is suggested by the manufacturer as an adjunct to production lines of companies already engaged in other forms of plastics fabrication as well as for developmental, experimental, and short-run work.

The unit has 18- by 18-in. platens, timers, vacuum gage, a 3-cu. ft./min. vacuum pump, 15-gal. vacuum surge tank, and automatic cycle control. The 22- by 22-in. heater has a 3½-kw. capacity. Molds of any size from 2 by 2 to 16 by 16 in. can be used. Draws up to a depth of 5 in. are said to be obtainable. *Vacuum Forming Corp., Port Washington, N. Y.*

Shielded Room—For enclosing electronic preheaters and other types of equipment whose operation may interfere with radio or TV transmission in violation of FCC regulations, a shielded room, using copper (Model 146DB) or bronze (Model 128 DB) screens, is said to meet U. S. Government performance specifications. The room is constructed with a floor having cross-beams every 12 in., 1-in. plywood



Hydraulic Press' Model 1200-H-80 injection machine has 36-in. mold clamp stroke

The *Answer* to Faster Injection Times...

The 'DOWDING' Patent Heating and Injection Cylinder

The short injection stroke of the Injection Plunger—operating upon homogeneously plasticized material at the nozzle end of the Heating Cylinder—produces a direct displacement of material and does not have to transmit pressure through layers of granular and semi-plasticized material.

The special 'finned' design of Heating Cylinder gives homogeneous plasticizing at high rates and is 'pre-filled' during the molding closing stroke.

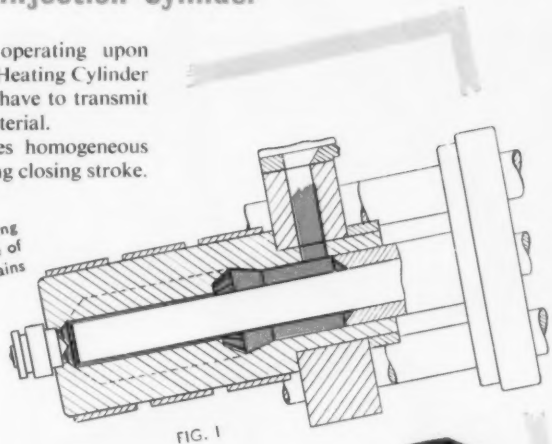


FIG. 1

Fig. 1.—FORWARD POSITION. Here the prefilling ring has drawn back clear of the feed and a fresh charge of material passes into the cylinder; the plunger remains forward.

Fig. 2.—BACK POSITION. After the new charge has been drawn in, the prefilling ring travels forward, compressing the material at the same time as the plunger moves back ready for its forward injection stroke. The nozzle is designed to restrict the escape of material during this action.

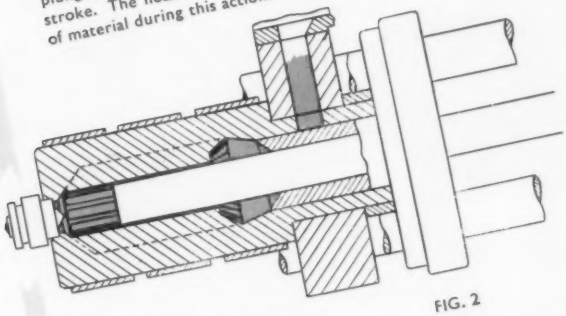


FIG. 2

BRITISH-BUILT

DOWDING

Fully Automatic Fast-Cycling

INJECTION MOLDING MACHINE

Sole Distributors for U.S.A.
Ralph B. Symons Assoc. Inc.
3571 Main Road, Tiverton, R.I.

CUTS MOLDING TIMES AND COSTS

SIMPLE TOOLING ENABLES RAPID MARKETING

RAPID DELIVERY

SPECIFICATION

Approximate weight of material plasticized per hour (Dependent upon weight per shot and material used)	22 lb.
Area of Injection plunger	2.074 sq. in.
Pressure per square inch on material at end of plunger	9,100 lb.
Total pressure on Injection plunger	18,850 lb.
Mold opens (adjustable)	6—9 in.
Maximum die space	7¼ in.
Minimum die space	3½ in.
Maximum recommended casting area in mold	15 sq. in.
Size of die plates	16 x 10 in.

DOWDING & DOLL LTD

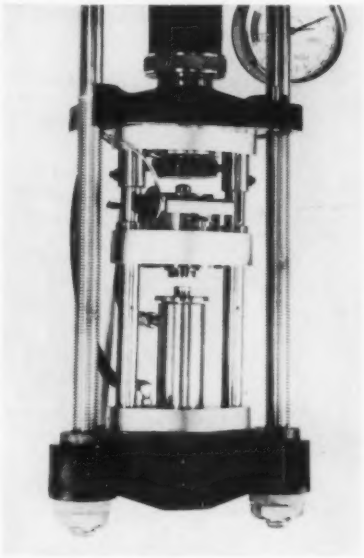
346 KENSINGTON HIGH STREET · LONDON · ENGLAND

Cables: ACCURATOOL HAMMER LONDON

76A

flooring covered with ⅛-in. linoleum, and has leakproof doors and leakproof air intake. *Erik A. Lindgren & Associates, 4515 N. Ravenswood Ave., Chicago 40, Ill.*

Conversion Device—Plastic molding conversion unit is reported to adapt standard hydraulic presses—laboratory size or larger—for injection, transfer, or extrusion molding operations. The device is self-contained and can be moved into and



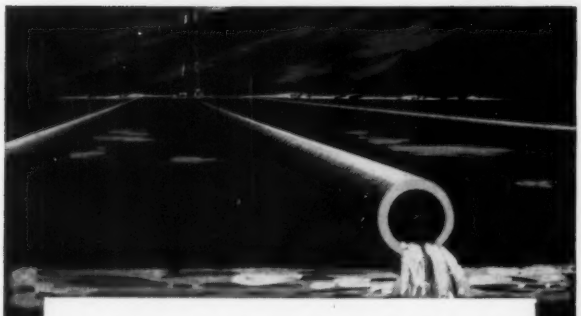
Plastic Machinery Exchange's attachment adapts standard hydraulic press to injection, transfer, and extrusion molding

out of the press instantly and operated without changing the press in any respect. No special attachments are needed. The unit is designed for work of an experimental nature as well as for small production runs.

The pressure ram can be operated directly from plant pressure line or from an independent source. Pumps, hoppers, etc., can be supplied as required. *Plastic Machinery Exchange, 426 Essex Ave., Boonton, N. J.*

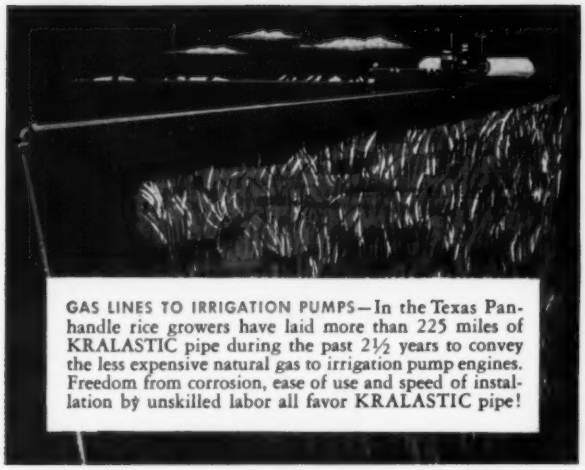
Bag Maker—The Magni-Velope Automatic is designed for the mass production of large polyethylene bags; liners for barrels, boxes, cartons, cases, and drums; and for specialized protectors. The bag maker unit is said to be capable of producing bags up to 40 by 70 in., uniformly sized. *Crystal-X Corp., Box 403, Lenni Mills, Pa.*

KRALASTIC Corrosion-Proof Pipe Makes Good in Many Fields!

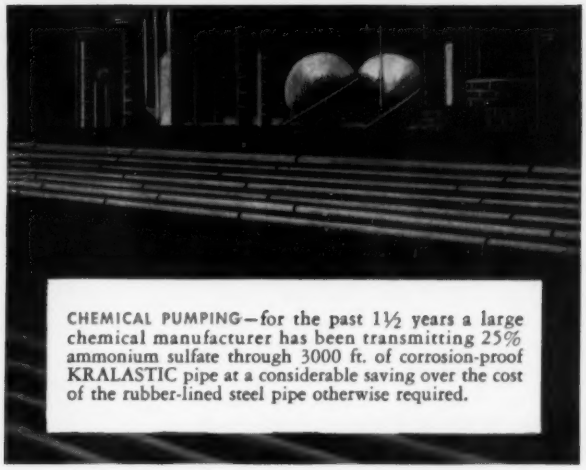


SALT WATER DISPOSAL—Operating under 20" to 28" of vacuum at 110° F. in a Texas oil field, a 4100 ft. stretch of 4" KRALASTIC pipe is still going strong after two years. A previous installation of pipe lasted only 6 weeks.

OIL FLOW LINES—Carrying very corrosive sour crude, a 1200 ft. section of 3" KRALASTIC pipe has performed satisfactorily for more than 2½ years for a Texas oil company. Metal pipe previously used failed in only 4 months.



GAS LINES TO IRRIGATION PUMPS—In the Texas Panhandle rice growers have laid more than 225 miles of KRALASTIC pipe during the past 2½ years to convey the less expensive natural gas to irrigation pump engines. Freedom from corrosion, ease of use and speed of installation by unskilled labor all favor KRALASTIC pipe!



CHEMICAL PUMPING—for the past 1½ years a large chemical manufacturer has been transmitting 25% ammonium sulfate through 3000 ft. of corrosion-proof KRALASTIC pipe at a considerable saving over the cost of the rubber-lined steel pipe otherwise required.

KRALASTIC pipe is made from a unique combination of plastic and elastomeric materials. It is different both in composition and charactersitics from materials used in other types of plastic pipe.

KRALASTIC produces pipe and pipe fittings that are both hard and tough, low in weight, high in tensile strength and unaffected by most chemicals that corrode metals.

Molders and extruders are finding KRALASTIC ideal for such products as combs; wheels; window channels; cases for small appliances such as hearing aids and electric shavers; housings for office and other types of machines, as well as for pipe. For further information on KRALASTIC, or for the names of the makers of KRALASTIC® pipe, write or phone us.

HAUGATUCK

Naugatuck Chemical

Division of United States Rubber Company
Naugatuck, Connecticut

US RUBBER

BRANCHES: Akron • Boston • Charlotte • Chicago • Los Angeles • Memphis • New York • Philadelphia • IN CANADA: Naugatuck Chemicals, Elmira, Ontario
Rubber Chemicals • Synthetic Rubber • Plastics • Agricultural Chemicals • Reclaimed Rubber • Latices • Cable Address: Rubexport, N.Y.

BOOKS AND BOOKLETS

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"ASTM Standards on Rubber Products"
"ASTM Standards on Paint, Varnish, Lacquer, and Related Products"
"1954 Supplement of Book of ASTM Standards, Including Tentatives, Part VI"

Published in 1955 by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. (Number of pages and prices are given below.)

A number of new standards and revisions relating to the plastics field have been issued by ASTM.

"ASTM Standards on Rubber Products" (684 pages, $5.50), prepared by Committee D-11 on Rubber and Rubber-like Materials, gives over 110 specifications and test methods, including processibility tests, aging and weathering test, low-temperature tests, non-rigid plastics, latex foam, sponge and expanded cellular rubber, hose and belting, tape, electrical protective equipment, electrical tests, etc.

"ASTM Standards on Paint, Varnish, Lacquer, and Related Products," the ninth edition of this particular compilation (868 pages, $6.00), lists more than 200 specifications, tests, and definitions, based on work being done by Committee D-1. Included, as information only, are proposed specifications published in draft form for purposes of soliciting comment. Subjects covered by this book include pigments; drying oils, paint dryers, and thinners; shellac and varnish materials; naval stores; lacquers and lacquer materials; traffic paint; bituminous emulsions; printing inks; paint tests; putty; and paint weathering tests.

"1954 Supplement to Book of ASTM Standards, including Tentatives, Part IV" on rubber, plastics, and electrical insulation (532 pages, $3.50) brings the 1952 book of standards up-to-date so as to provide all applicable specifications, tests, definitions, etc., in their latest form. Topics covered are as follows: Rubber products (chemical, physical, aging, and low-temperature tests); automotive and aeronautical rubber; packing and gasket materials; hose; insulated wire and cable; latex foam, sponge, expanded cellular rubber; rubber latex; electrical tests. Plastics (specifications, strength, hardness, thermal, optical, and permanence properties; analytical methods, molds and molding process, definitions and nomenclature). Electrical insulating materials (shellac, varnish, mineral oils, fabrics, papers, mica); and electrical tests.

"Principles of Emulsion Technology," by Paul Becher

Published in 1955 by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. 149 pages. Price: $2.95.

Another in the Pilot Book series, this one, dealing with the general principles of emulsion formulations, is addressed primarily to students of chemistry who want to become more familiar with this chemical art. Topics covered include: dispersions and emulsions, surface activity, theory of emulsions, chemistry of emulsifying agents, emulsifying equipment, testing of emulsion properties, emulsion formulations, and demulsifications.

"British Plastics Year Book, 1955"

Published in 1955 by Iliffe and Sons Ltd., Dorset House, Stamford St., London S. W. 1, England. 652 pages. Price: 30s (ca $4.20).

The 25th edition of this classified guide to the British plastics industry is divided into nine sections as follows: Classified lists of manufacturers and suppliers of materials, finished products, and equipment; list of trade and proprietary names, both for materials and finished products, including a plastics glossary; list of names and addresses of about 400 firms associated with plastics, grouped by countries; a Who's Who section with names and positions of prominent people in British plastics industry; annual review of patents, providing in 139 pages relevant patents, collected, abstracted, and arranged by subject groups; list of new plastics companies registered during 1954. In addition, the handbook provides technical and general data, specifications relating to plastics, and other useful information.

"Designing for People," by Henry Dreyfuss

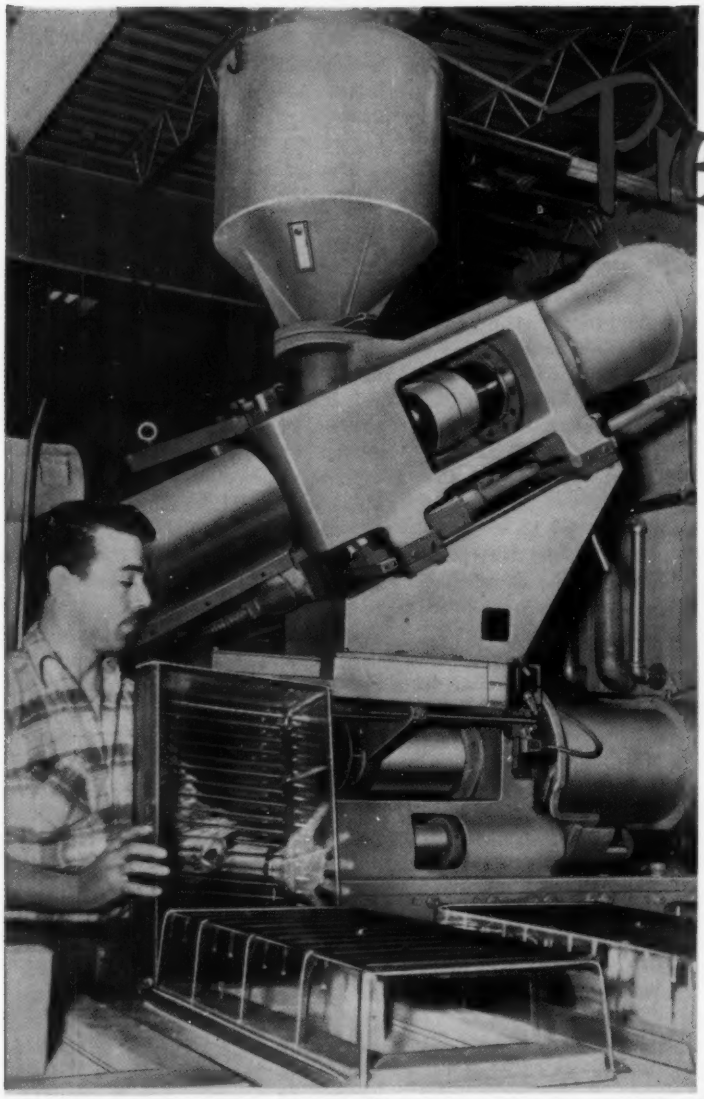
Published in 1955 by Simon and Schuster, Inc., 630 Fifth Ave., New York 20, N. Y. 240 pages. Price: $5.00.

Those desirous of gaining an insight into the mental processes that lead to good industrial design will find this personal account of 25 years in the field by one of the masters of the art highly rewarding. Using his own experiences as background, the author describes the way in which he approached each design problem, the research he conducted in arriving at a solution, and the step-by-step procedure involved in an important design assignment. Needless to say, plastics played an important role in the author's career, and he tells of various applications wherein they were used. Written by a designer with a literary bent, the book makes excellent reading.

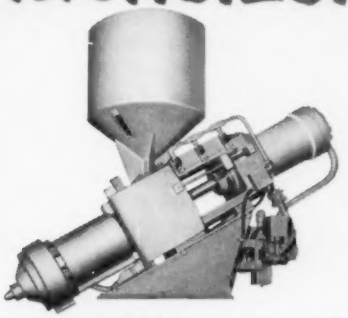
"Emulsion Polymerization," by Frank A. Bovey, I. M. Kolthoff, Avrom I. Medalia, and Edward J. Meehan

Published in 1955 by Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y. 445 pages. Price: $12.50.

Number 9 in a series of monographs on the chemistry, physics, and technology of high polymeric substances, this volume has as its aim the presentation of a concise and systematic interpretation of the various aspects of emulsion polymerization, with special emphasis on the kinetics of the process. The chapters include discussions of the nature of free-radical polymerization (emulsion polymerization initiated by free radicals); chain transfer agents (an understanding of whose behavior is necessary to a clear understanding of modification in emulsion polymerization); inhibition, retardation, and copolymerization. One chapter is devoted to a study of the emulsion polymerization of styrene. Since most of today's knowledge of emulsion polymerization has been gained in the development of GR-S, a discussion of properties and recipes for the



WATSON-STILLMAN Preplasticizers



cut molding cycles ⅓ to ½!

Production speed-up—often by as much as ⅓ to ½—is only one of many reasons why it will pay you to install a ***Preplasticizer*** on your present W-S Injection Molding Machine.

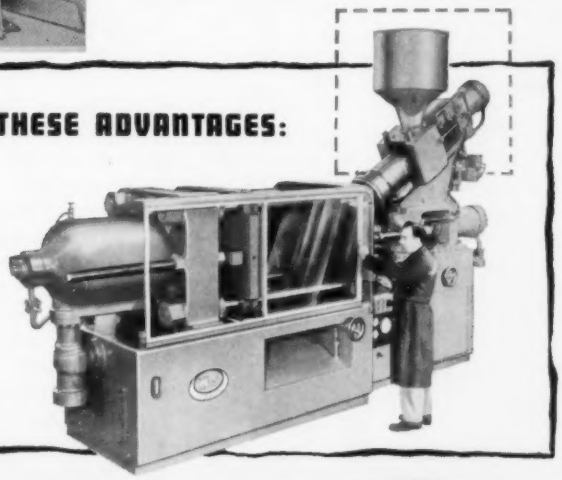
For instance, a ***Preplasticizer*** also can help you make savings on material . . . produce finished products virtually free of stress and strain (scrap loss, breakage and rejections are all reduced) . . . improve product quality, both in coloring and material.

Watson-Stillman makes Preplasticizing Units for all standard injection molding machines from 16 oz. to 85 oz. capacities. W-S also manufactures a "Completeline" of injection, transfer and compression molding machines in a wide range of capacities.

W-S PREPLASTICIZING UNITS OFFER THESE ADVANTAGES:

- Shorter molding cycles
- Better control of thickness of shots
- Lower injection pressures—better finished items
- Greater uniformity in material and coloring
- Thinner sections possible

Send us your requirements. Let us show you how preplasticizing can help you increase your production, improve your product.



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THE WATSON-STILLMAN COMPANY
DIVISION OF H. K. PORTER COMPANY, INC.
150 Aldene Road, Roselle, N. J.
Foreign Sales Representatives: OMNI PRODUCTS CORP., 460 Fourth Avenue, New York 16, N. Y.
Correspondents Throughout the World

W-S HYDRAULIC ESTABLISHED 1848

preparation of GR-S is included, with two chapters dealing with the standard recipe and modern rodox recipes.

"Corrosion Data Survey," compiled by G. A. Nelson

Published in 1954 by Shell Development Co., Emeryville, Calif. 20 text pages. 69 fold-out charts. Price: $35.00.

Corrosion resistance of commonly used materials of constructions (those that are available at reasonable cost and in a wide variety of forms) to about 1000 chemicals is presented in chart form in this handbook. Information for each material and corrodent is plotted in terms of concentration of corrodent, temperature, corrosion rates, and certain secondary factors. Among the materials considered are iron, steel, brass, nickel, lead, aluminum, copper, glass, concentrate, wood, the various plastics materials, and others.

This collection of charts is an invaluable aid in determining the feasibility of construction materials for any particular application.

Plastics in India—Proceedings of the Seventh All India Plastics Manufacturers' Conference contain the addresses and papers delivered at that meeting and the resolutions passed by it. The addresses were concerned largely with the general economic status of the plastics industry in India, while the reports dealt in the main with problems of mold making. *The All India Plastics Manufacturers' Association, Chowpatty Chambers, Sandhurst Bridge, Bombay, India.*

Colorants—Technical Bulletin 130 presents a line of color paste concentrates for coloring epoxy, Thiokol, polyurethane, and isocyanate resins. The colorants are claimed to have unlimited shelf stability; to have no inhibitory effect on cure; and to be fast to heat, light, and catalyst. Price list is included. *Claremont Pigment Dispersion Corp., 110 Wallabout St., Brooklyn 11, N. Y.*

Exhaust systems—Eight-page brochure discusses selection and installation of corrosion-proof polyethylene ventilating and exhaust systems. It presents suggestions on installing such systems by using prefabricated components and fittings. One section illustrates and describes various possible complete installations, and explains how potential users may compile a list of necessary materials and compute the cost. Covered are polyethylene seamless ducting, duct fittings, exhaust hoods, centrifugal fans, weather caps, and others. *American Agile Corp., P.O. Box 168, Bedford, Ohio.*

Polyesters—"Fabricating With Laminac Resins" presents detailed information on the properties and uses of a line of liquid thermosetting polyester resins. Included are data on physical and chemical properties, catalysts and promoters, and methods of reinforced plastics fabrication. In the latter category are included open mold forming, bag molding, matched metal die molding, and continuous laminating; procedures, advantages, disadvantages, and typical applications are given for each method. Sections on casting with Laminac resins and on parting agents are also included. *American Cyanamid Co., Plastics and Resins Div., 30 Rockefeller Plaza, New York 20, N. Y.*

Shelf supports—Catalog AS-64 presents a complete line of plastic shelf supports for refrigerators, freezers, and cabinets. The supports are one-piece units said to eliminate the possibility of chipping or cracking and to permit "blind" assembly. Photos, cross-sectional views for each model, and specifications of sizes, are included. *Shakeproof Div., Illinois Tool Works, St. Charles Rd., Elgin, Ill.*

Molybdenum pentachloride—Bulletin Cdb-3 gives the more important physical and chemical properties of chemically pure molybdenum pentachloride and describes the preparation of the compound. Also covered are reaction of molybdenum pentachloride with oxy and hydroxy compounds, nitrogen compounds, and phenolics; its function in organic addition reactions; action as a catalyst in chlorinations; reaction with carbon monoxide to form molybdenum carbonyl; and its reduction to the trichloride and to the metal. *Climax Molybdenum Co., 500 Fifth Ave., New York 36, N. Y.*

Box catalog—Brochure on molded plastics boxes catalogs a line of rigid, transparent containers for packaging purposes. Over 50 models in some 150 sizes are illustrated and described. Boxes are available with hinged snap closures, in colored or clear plastic; covers with or without decorative designs and contrasting paintings; slant covers; and compartmented interiors. *The Harmon Co., Inc., 331 Madison Ave., New York 17, N. Y.*

Weight and force measurements—Bulletin 4301 describes SR-4 load cells and load beams for electrical measurement of weight and force. Principles of measurement, specifications of load sensitive devices, available instrumentation, and typical applications are included in the bulletin. *Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.*

Polymers—Four standard polyvinyl acetate polymers, and four special polymers are described in this four-page brochure E-12. The booklet lists characteristics of the emulsions, special features, and typical end uses. A comparison chart also lists total solids contents, viscosity, blocking temperature, particle size, etc. *Dewey and Almy Chemical Co., 62 Whittemore Ave., Cambridge 40, Mass.*

High-pressure laminates—Color brochure reproduces in full color the various patterns of the Nevamar line of high-pressure laminates, including wood grains, mother of pearl, nub linen, riviera, and solids. The laminate, produced in standard sizes of 24 to 48 in. wide by 60 to 96 in. long, 1/16 in. thick, is used in the furniture and building trades for sink tops, table tops, work surfaces, wall paneling, counter tops, bars, desks, and cabinets. *The National Plastics Products Co., Odenton, Md.*

Preventive maintenance—This manual lists suggestions for preventive maintenance on V-belt drives. Trouble-shooting hints are given. *The Dayton Rubber Co., Dayton, Ohio.*

Defense contract regulations—Detailed description of the Defense Materials System (DMS) and instructions for contractors engaged in defense work, are presented in this handbook. It is not intended as a subsitute for DMS regulations, but rather is designed to indicate why

a materials and production control system is needed and to describe the fundamental characteristics of DMS. 25¢. *Superintendent of Documents, Government Printing Office, Washington 25, D. C.*

Patents—"Keys to Progress" explains briefly how the U. S. Patent System works; it indicates, through case histories, how potent a stimulus the system is to competition and to the creation of new and useful processes and products. *Esso Research and Engineering Co., 15 W. 51st St., New York 19, N. Y.*

Magnetic separators—Descriptions of magnetic separators used in many industries are given in this 24-page booklet, B-213. Case histories show how various companies are using permanent, non-electric magnets to prevent iron contamination in their products, protect their machinery from damage by tramp iron, and prevent fires. Over 100 suggested uses are indicated. *Eriez Manufacturing Co., Erie, Pa.*

S.P.E. conference—Papers presented at the 11th Annual National Technical Conference of the Society of Plastics Engineers have been collected in this 530-page volume. These papers cover a wide range of topics, including fluorocarbons, polyethylene, controls, reinforced plastics tooling, molding, laminating, and others. For abstracts of these papers, see MODERN PLASTICS *32*, 128 (Feb. 1955). $3.00 for members, $7.50 for non-members. *The Society of Plastics Engineers, Inc., 34 E. Putnam Ave., Greenwich, Conn.*

Polyethylene film—Price and ordering information for Polyfilm (untreated virgin polyethylene film) and Polytreat (virgin polyethylene film treated for ink adhesion) are contained in 4-page folder. A table showing yield per pound of film for given gages is included. *Extruders, Inc., 3232 W. El Segundo Blvd., Hawthorne, Calif.*

Plastisol—Technical data on the properties, compounding, and application of Opalon 410 vinyl plastisol resin are contained in this 22-page report. The booklet describes the effect of ingredients on the finished compound, with special reference to compound viscosity. Components covered are primary and secondary plasticizers, fillers, pigments, stabilizers, surface active agents, and diluents. Also covered are mixing, de-aeration, and fusion operations. *Monsanto Chemical Co., 1700 S. Second St., St. Louis 4, Mo.*

Design handbook—"Handbook of Instructions for Ground Equipment Designers," compiled for the Air Research and Development Command by Becker and Becker Associates, industrial designers, presents basic requirements for all ground equipment produced for the Air Force. Handbook specifies Air Force requirements but does not contain design techniques or how-to-build-it information. Subjects covered include armament, communication, navigation, photographic and recording equipment, aircraft support, training, rescue, aerial delivery, general base installations, meteorological, administrative, supply, transportation and personal equipment. The book is intended primarily for distribution to Air Force prime contractors, although other manufacturers who can show need may be able to obtain a copy. *Wright Air Development Center, Wright-Patterson Air Force Base, Ohio, WCXH.*

Teflon—Finished products and parts made of Teflon are described in this four-page brochure. Also presented is a table showing properties of Teflon. *Sparta Mfg. Co., P. O. Box 66, Dover, Ohio.*

Movies about plastics—"Have a Hobby," a 16-mm. color film, shows how assembling plastic models of everything from early American housewares and antique autos to jet aircraft can establish a sense of joint accomplishment in the family, and how finished models lend an air of charm as home decorations. Running time is 13 minutes. "Children's Party," a new short color film, offers suggestions on how to plan for a party and how to wrap presents decoratively by using plastic materials. Both films are available free to television program directors, women's clubs, schools, and department stores. *Monsanto Chemical Co., Plastics Div., Springfield, Mass.*

Colorants—Heat stability, light stability, alkali resistance, and relative strength characteristics of a range of

stir-in color pastes for vinyl plastisol compounds are presented in Technical Bulletin 140. Over 50 colorants are covered. Methods used in determining the characteristics listed are described. Price list is included. *Claremont Pigment Dispersion Corp., 110 Wallabout St., Brooklyn 11, N. Y.*

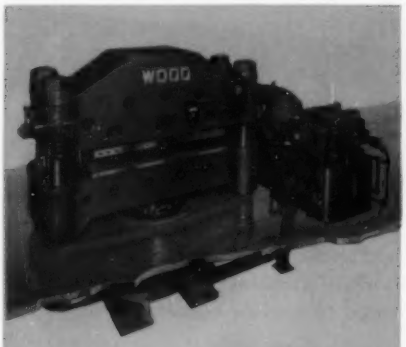
C-frame presses—Four-page catalog folder lists 11 sizes of C-frame hydraulic presses, ranging from 2- to 200-ton capacity. General specifications and dimensions are given for each model. Both bench and floor models are offered, and a choice of two manual control systems is available. All models have inching control, high-speed differential circuit, ram reversal on pressure setting, and ram reversal on stroke length setting. *The Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.*

Protective coatings—Bulletin No. 7-2 gives product information on a line of standard protective coatings. Included are neoprene heavy duty, neoprene extra heavy duty, styrene, chlorinated rubber, and epoxy resin based coatings. *The Atlas Mineral Products Co., Mertztown, Pa.*

Reinforced plastics—Circulars describe gradation Tropiglas, expanded Tropiglas, and GOH electrical insulation sheet. The first is a line of reinforced plastics glazing panels that transmit varying amounts of light but reflect approximately identical amounts (see MODERN PLASTICS *31*, 83, Feb. 1954); the second is a glass reinforced polyester laminate consisting of two flat sheets produced in one operation to form an envelope of air space into which an expander is inserted (see MODERN PLASTICS *32*, 91, Feb. 1955); the last is a fibrous glass-polyester laminate with good electrical properties and self-extinguishing characteristics. *Russell Reinforced Plastics Corp., Lindenhurst, N. Y.*

Surface coating—Prepared jointly by the Surface Coating Resin Section of the British Plastics Federation and the Surface Coating Synthetic Resin Manufacturers Association, "Surface Coating Resin Index" gives in 14 tables the basic information on all the British-made surface coating resins at present available to the

(*To page* 186)

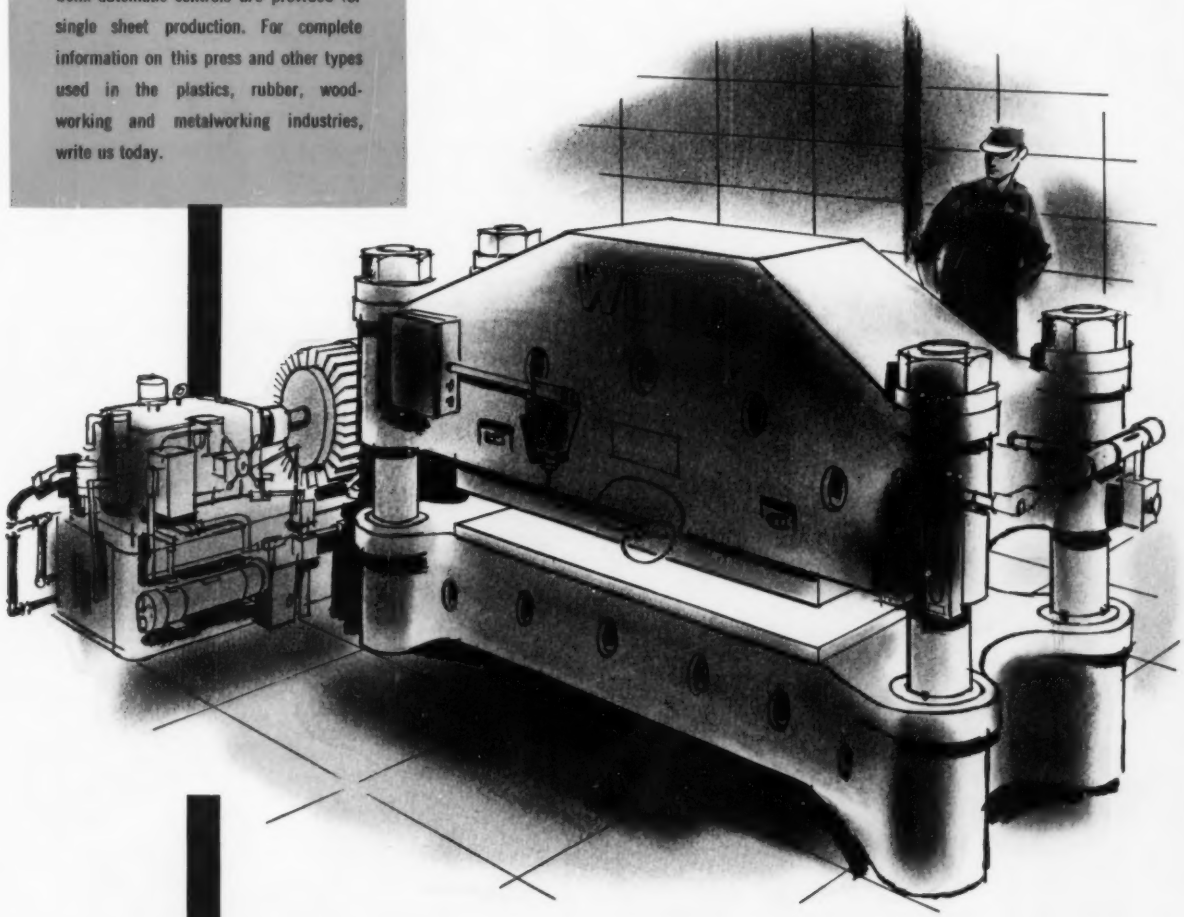


Single Opening 500-ton Embossing Press for use on leather and plastic products. Fully automatic operation with suitable feeding mechanism permits pressing of sheets at rate of 12 cycles per minute. Semi-automatic controls are provided for single sheet production. For complete information on this press and other types used in the plastics, rubber, wood-working and metalworking industries, write us today.

Success is seldom accidental

People and products *do* stumble into success. But not often. The success of R. D. Wood presses, for example, stems from unremitting attention to details. Every R. D. Wood press is the product of sound design, carefully chosen materials, conscientious workmanship.

This is why R. D. Wood presses consistently deliver the utmost in smooth, dependable performance; fast, economical production; and trouble-free operation. And this is why so many leading press-users specify R. D. Wood.



R. D. WOOD COMPANY

PUBLIC LEDGER BUILDING • PHILADELPHIA 5, PENNSYLVANIA

Representatives in Principal Cities

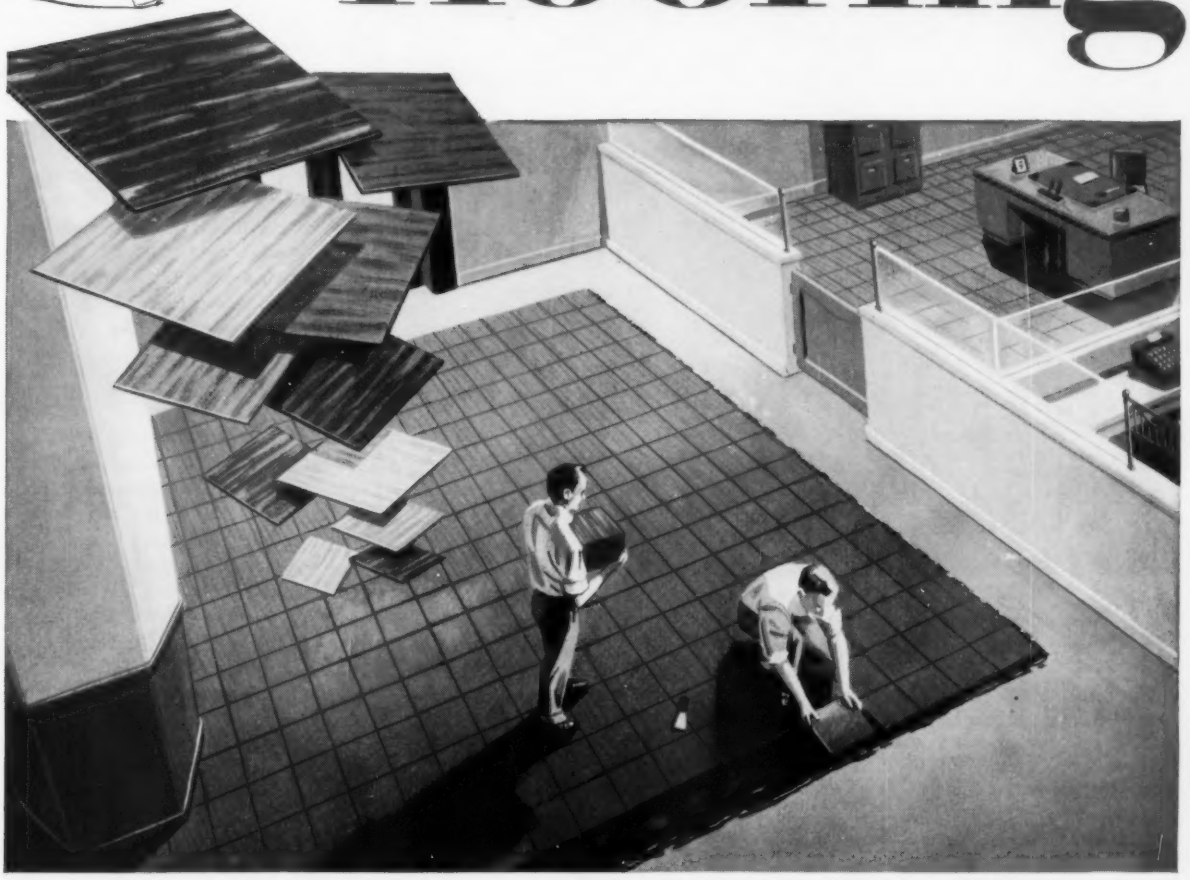
MAKERS OF HYDRAULIC PRESSES AND VALVES • FIRE HYDRANTS • CAST-IRON PIPE • GATE VALVES • GAS PRODUCERS • ACCUMULATORS

EXON: each resin engineered for a specific problem

EXON 468

specifically for

flooring



Higher bulking density of EXON 468 increases the banbury output 10 to 25%! It makes processing easier, since it permits fast fusion at reduced temperatures.

A superior resin in every respect, EXON 468 offers good heat and light stability, high thermoplasticity, compatibility with conventional vinyl plasticizers, stabilizers and pigments.

Used as the base resin in vinyl asbestos floor tile formulations, EXON 468 provides new production economies — and superior end products.

For suggestions on developing new products, or improving established ones with EXON 468—or for complete information or technical service on the growing line of versatile EXON resins, contact:

Firestone

CHEMICAL SALES DIVISION
FIRESTONE PLASTICS COMPANY, POTTSTOWN, PA., DEPT. 2P
DIVISION OF THE FIRESTONE TIRE & RUBBER COMPANY

paint, printing ink, and allied industries. The resins, 733 in all, have been classified according to type and, within each of the 14 classifications, are listed in alphabetical order by tradename. A list of all producers contributing is also included. 3s (ca. 35¢). *British Plastics Federation, 47 Piccadilly, London, W. 1, England.*

Package merchandising—"How to Merchandise With Corrugated Boxes," investigates the criteria for box design and color in merchandising, e.g. consideration of the product, of the people who will buy the product, of the methods of distribution, and the activities of competing firms. The psychology, function, and selection of color in merchandising are discussed. Specific merchandising functions around which a line of corrugated boxes are designed, illustrated with actual boxes and displays being used by leading firms, are also discussed. *Hinde & Dauch, Sandusky, Ohio.*

Chemical specialties—Bulletin lists the analyses of over 750 household and automotive chemical specialties including waxes, polishes, detergents, cleaners, shampoos, and deodorants. The analytical reports contain a complete chemical analysis with qualitative and quantitative data and interpretation in terms of commercial ingredients. The reports are available at $15.00. The bulletin also announces the availability of manufacturing formulas of eight specialties including a wax, automobile cleaner, degreaser, handsoap, and shoe polish. These formulas, at $25.00, contain sufficient information to permit immediate production—including sources of raw materials, equipment needed, and manufacturing process. A monthly Chemical Specialties Information Service at $15.00 per month provides the analyses of five new specialties every month. *Chemical Specialties Research Laboratories, Box 33, Ansonia Station, New York 23, N. Y.*

Small boiler—Bulletin 6H describes a line of gas-fired automatic steam boilers of small horsepower for process work during all seasons, eliminating the cost of operating a main boiler having a capacity of many times the process steam requirements during the warm months of

the year. *Mears-Kane-Ofeldt, Inc., Div. of S. T. Johnson Co., Church Rd., Bridgeport, Pa.*

Laminating resin—Technical bulletin presents specification and property data on a line of phenolic-type laminating resins, said to be formulated to meet the special requirements in cloth and paper laminates for electrical resistance, mechanical strength, low water absorption, and decorative qualities. Curing range for laminates using these resins is 300 to 320°F. at pressures up to 2000 p.s.i. for high-pressure laminates and up to 400 p.s.i. for low-pressure laminates. *Synvar Corp., Wilmington 99, Del.*

High-gloss impact styrene—Catalog 414 describes an impact styrene with a high-gloss surface finish. The finish resembles porcelain enamel in surface brilliance and is washable. The material is available in a wide range of sheet thicknesses and colors and can be made into complex shapes on a production basis by vacuum forming or by other production techniques used with rigid thermoplastic sheet. Examples of actual applications of the material are shown. New uses also are suggested. *Campco Div., Chicago Molded Products Corp., 2717 N. Normandy Ave., Chicago 35, Ill.*

Safety signs—Bulletin 145-C catalogs over 1000 stock general-purpose and specific-purpose accident prevention signs in wording and colors specified by American Standards Association standard Z-35.1-1941. Backed with pressure-sensitive adhesive, the impregnated cotton cloth signs can be applied by unskilled personnel or plane or irregular surfaces. General-purpose and special-purpose signs can be easily combined to create large accident-prevention signs. *W. H. Brady Co., 727 W. Glendale Ave., Milwaukee 12, Wis.*

Metallizing—Steps involved in spray-metallizing plastics parts and components are outlined in this four-page folder. Services offered by a company specializing in both the production of spray-metallizing solutions and actual production spray metallizing are also described. *Jema Chemical & Supply Co., 191 South St., Newark 5, N. J.*

Production of

FOR the purpose of this report, production is the sum of the quantities of materials produced for consumption in the producing plant for transfer to other plants

PLASTICS AND SYNTHETIC RESIN PRODUCTION IN
From Statistics Compiled

Materials
CELLULOSE PLASTICS:[a]
Cellulose acetate and mixed ester
Sheets, under 0.003 gage
Sheets, 0.003 gage and over
All other sheets, rods, tubes
Molding, extrusion materials
Nitrocellulose sheets, rods, tubes
Other cellulose plastics
PHENOLIC AND OTHER TAR-ACID RESINS:
Molding materials[a]
Bonding and adhesive resins for:
Laminating (except plywood)
Coated and bonded abrasives
Friction materials (brake linings, clutch facings, etc.)
Thermal insulation (fiber glass, rock wool)
Plywood
All other bonding and adhesive uses
Protective-coating resins
Resins for all other uses
UREA AND MELAMINE RESINS:
Textile-treating and textile-coating resins
Paper-treating and paper-coating resins
Bonding and adhesive resins for:
Plywood
All other bonding and adhesive uses, including laminating
Protective-coating resins
Resins for all other uses, including molding
STYRENE RESINS:
Molding materials[a]
Protective-coating resins
Resins for all other uses
VINYL RESINS, total[b]
Polyvinyl chloride and copolymer resins (50 percent or more polyvinyl chloride) for:
Film (resin content)
Sheeting (resin content)
Molding and extrusion (resin content)
Textile and paper treating and coating (resin content)[c]
Flooring (resin content)
Protective coatings (resin content)
All other uses (resin content)
All other vinyl resins for:
Adhesives (resin content)
All other uses (resin content)
COUMARONE-INDENE AND PETROLEUM POLYMER RESINS
POLYESTER RESINS:
For reinforced plastics
For all other uses
MISCELLANEOUS:
Molding materials[a,d]
Protective-coating resins[e]
Resins for all other uses[f]

* Dry basis designated unless otherwise specified.
** Partially estimated. † Revised.
[a] Includes fillers, plasticizers, and extenders. [b] Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total production are given. [c] Includes

Plastics Materials

of the same company, and for sale. Sales include only the quantities involved in bona fide sales in which title passes to the purchaser.

POUNDS[a] FOR JANUARY AND FEBRUARY 1955 by U. S. Tariff Commission

January		*February*	
Production	*Sales*	*Production*	*Sales*
1,520,519	1,420,649	1,557,880	1,536,209
1,201,385	1,060,458	1,087,250	1,119,631
567,948	481,372	569,860	533,127
6,907,671	6,867,887	7,177,347	6,950,739
414,134	454,283	364,282	431,677
552,980	474,252	558,857	606,509
†16,206,920	†15,917,500	16,345,390	15,218,611
†5,325,117	†3,992,509	5,933,601	4,059,861
979,042	1,189,855	1,068,126	1,182,690
†1,703,157	†1,594,609	1,938,200	1,746,276
2,801,052	2,987,473	2,997,757	3,066,197
3,346,946	2,980,777	4,395,022	3,673,399
1,138,545	1,249,081	1,080,812	1,105,058
†1,959,996	†1,934,224	2,279,802	1,924,877
†2,892,746	†2,613,462	3,436,283	3,440,805
3,800,099	3,528,808	3,288,164	3,394,559
1,542,748	1,485,564	1,763,336	1,821,155
6,916,303	6,430,586	7,680,516	6,791,343
2,344,034	2,317,204	2,029,973	2,090,016
†2,833,025	2,236,671	2,887,509	2,184,306
6,094,572	5,894,180	5,914,349	5,857,477
30,952,840	28,537,419	28,875,719	29,315,737
†7,909,726	7,494,957	8,228,063	8,133,571
5,906,750	5,587,227	7,270,514	6,330,022
†53,781,795	†51,207,860	51,650,358	52,400,339
	6,290,815		6,606,264
	4,454,684		4,204,742
	15,441,360		15,747,702
	4,512,353		4,828,825
	4,340,504		4,812,067
	2,287,582		2,285,463
	3,600,105		3,801,149
	†2,575,812		2,352,688
	†7,704,645		7,761,439
18,323,510	18,404,461	19,159,530	19,051,034
2,788,842	2,182,619	2,878,278	2,062,794
813,491	998,498	982,995	972,062
22,870,752	17,545,816	24,714,283	18,308,354
†438,193	221,038	343,997	239,555
†9,333,162	†11,854,840	8,466,658	12,790,406

data for spreader and calendering-type resins. [d] Includes data for acrylic, polyethylene, nylon, and other molding materials. [e] Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective-coating resins. [f] Includes data for acrylic, rosin modifications, nylon, silicone, polyethylene, and other plastics and resins for miscellaneous uses.

New Reinforcement

A NEW type of glass reinforcement for plastics resins called "Filmglas," is announced to be under development by Owens-Corning Fiberglas Corp.

Appearing in the form of fine flat glass scales, Filmglas is made by a patented process which involves blowing a tube or bubble of glass 0.0001 to 0.0002 in. in thickness, and shattering it.

The product, now being produced in pilot lots, can be had bare or may be prepared with a number of treatments including Silane, Volan, silicone, phenolic, etc.

Aside from its prospective economy—costs are projected in volume production at from 20 to 30 cents a pound, depending upon finish, particle size, and quantities delivered—the new glass reinforcement appears to the company's technicians to offer remarkable flexibility in molding of premixes, in casting of reinforced resins, and in laminating—the latter possibly in conjunction with other forms of reinforcements such as cloth and mat.

It has already been determined that a resin may be more heavily loaded with this material than with past forms of glass reinforcement. For example, polyesters have been loaded up to 85% and epoxies as high as 70 percent.

The product is also being experimented with in connection with foams of styrene, isocyanate, and silicones. A typical experimental foam involved the use of 20% by weight of Filmglas with 80% 7002 silicone, and this made for an increase of 50% in compressive strength over non-reinforced silicone foam at the same lb./cu. ft. densities.

The following list gives the reported properties of Filmglas:
Type glass—"E"
Flake thickness—8 microns (single)
Flake shape—random
Tensile strength—200,000 p.s.i.
Young's modulus—11 $\times$ 10^6 p.s.i.
Density—2.56 g./cc.
Refractive index—1.549
Moh's hardness—6 to 7
Dielectric strength—800 v./mil
Dielectric constant—6
Clarity—transparent

Samples are available in limited quantities for special applications.

Polyethylene film over outside scaffolding shields workmen inside

Construction Shield

BY PROTECTING materials and workmen against rain, snow, cold, and strong wind, sheets of 0.004 in. thick polyethylene film laid over existing wooden scaffolding make it possible for construction work to go on during more than half the days it would ordinarily be halted by bad weather. The shields also reduce construction lighting and heating costs and provide a comfortable atmosphere for construction workers in midwinter months, traditionally the time of considerable discomfort in working conditions.

On one recent job—the erection of a school building—nearly 5000 sq. ft. of film was laid over the construction scaffolding and held in place by boards and nails. Blocking winds up to 65 m.p.h. in velocity, the film helped hold in heat from gasoline-burning hot air heaters, permitting brick to be laid even when it was snowing outside. In addition, so much daylight was transmitted through the translucent film that workmen in outside rooms needed no artificial lighting. On milder winter days, sunlight shining through the film produced so much heat that it proved to be unnecessary to have any stoves turned on.

As the outer walls of the building were completed, the film was removed from the scaffolding, stapled into wooden frames, and fastened into window frames to shield workmen and the interior of the building until glass could be installed.

CREDITS: Made of polyethylene supplied by Bakelite Co., Visqueen film for construction purposes is produced by The Visking Corp., Terre Haute, Ind.

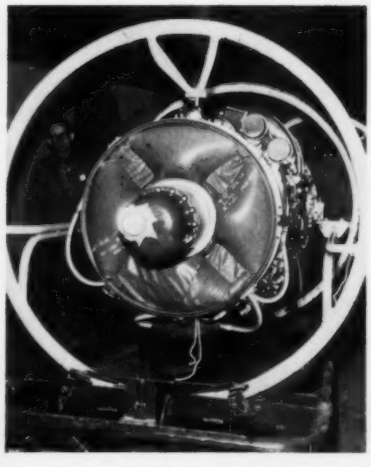
Jet Engine Cover

DEVELOPMENT of a vinyl cover for jet engines by Republic Aviation Corp. has, according to company officials, solved a long-standing assembly problem in aircraft production.

The cover, made up of sections of vinyl sheeting electronically sealed together, is inflated into place in the nose of the engine as soon as the engine is unpacked from its shipping crate. It thus provides a tight seal against the infiltration of dirt or foreign objects that might otherwise enter the engine.

The cover remains in place during the aircraft's progress along the assembly line and is removed only when the engine is ready to be run up on final inspection. Small openings in the main fuselage duct allow easy access to the vinyl valve by which the cover is deflated for easy removal. The wood-and-canvas covers previously used had to be removed as soon as the engines were installed, thus leaving the engine completely unprotected during assembly operations. If the all-vinyl cover should be inadvertently sucked into the engine, it can easily pass through the unit without causing damage to rotor blades or other parts. The covers can be re-used frequently and, since they are inflatable, are easier to store than bulky canvas covers.

CREDITS: Lustra-Cite Industries, Inc., New York, N. Y. a licensee of Republic Aviation Corp., manufactures the vinyl covers.



Inflated vinyl cover prevents dirt from infiltrating into jet engine

Folding Doors

NATURAL wood panels hinged together with extruded strips of flexible vinyl make up a new type accordion folding door which transforms one room into two in a second's time, saves the space of swinging doors, and brings a pleasant, modern look to interiors.

The vinyl connectors are made in eight colors to match or blend with the 64 standard finish combinations in which the wood panels are available. Each vinyl strip is about 1½ in. wide, approximately 3/32 in. thick, and is T-shaped on both sides. When assembling the door panels, the head of the T on the vinyl strip is simply inserted into a special slot cut into the edges of the panels.

Although flexible enough to permit the doors to be easily pulled out or folded in, the vinyl connectors are unusually tough. They will fold or flex for many years without cracking or showing signs of deterioration. Before being put on the market, the vinyl strips successfully met the M.I.T. flex test through 950,000 cycles. The vinyl connectors have the added advantage that they can be kept clean with a wipe of a damp cloth.

The panels are being assembled into doors ranging in size from 1 to 25 ft. wide or more.

CREDITS: Doors are marketed by Panelfold Doors, Inc., Hialeah, Fla.; strips are extruded by Thermoplastic Processes, Inc. Stirling, N. J., using Geon vinyl supplied by B. F. Goodrich Chemical Co.

Panels for accordion folding door are hinged together with vinyl strips

Two-piece housing for stereo viewer is formed of styrene copolymer sheet

Stereo Viewer

AN ATTRACTIVE dark green housing, formed in two parts of styrene copolymer sheet and hinged together, contributes both to the appearance and performance of a new type of internally illuminated stereo slide viewer.

The new viewer differs from conventional types in that it is designed to hold 50 different stereo slides at one time. All the slides are inserted into a rotating "cartridge" inside the plastic housing. As a knob on one side of the housing is turned, new stereo slides move continuously into view. No interruptions for changing slides are necessary until all 50 have been shown. Turning the same knob also serves to bring the picture into focus.

Although the flexible 5/64 in. thick styrene copolymer housing is rugged enough to provide complete protection for the slides—even if the viewer is accidentally dropped—it is so light in weight that the entire unit weighs only a few ounces more than conventional single slide viewers on the market today.

The housing is designed so that the edges of the top half overlap those of the bottom half to keep the interior of the unit free from dust. The handsome pebble grain surface finish of the housing can be wiped clean with a damp cloth.

CREDITS: Housing for the viewer marketed by Stereo "50" Viewer Corp., Hollywood, Calif., is formed by Engineering Plastics Co., Pasadena, Calif., using Royalite styrene copolymer sheet supplied by United States Rubber Co.

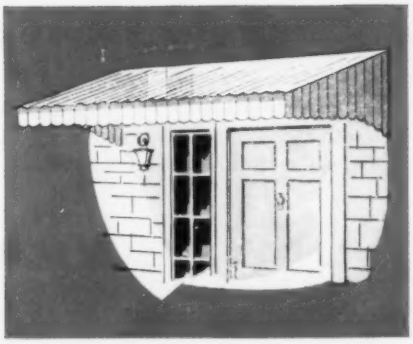
THERE'S A

GLIDPOL*

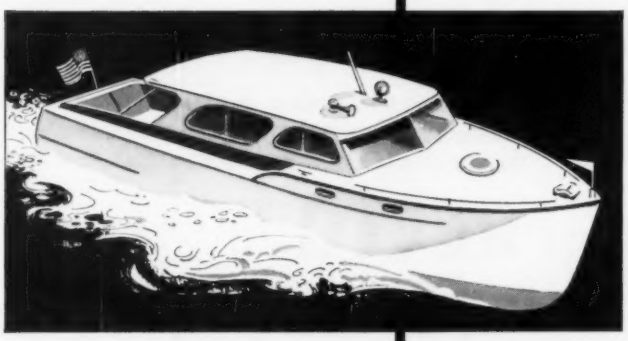
POLYESTER RESIN FOR EVERY PURPOSE

HAND LAYUP, ROOM TEMPERATURE-CURE MOLDING
Made of reinforced GLIDPOL resin, this eye-appealing display mannequin is molded and cured at room temperature without the introduction of heat.

MATCHED DIE MOLDING
Compression-molded at elevated temperature in a few minutes with GLIDPOL, this automatic washer tub has superior corrosion and alkali resistance.



LAMINATING WITH PIGMENTED STABLE RESIN. These colorful, weatherproof awnings, laminated with pigmented GLIDPOL, offer excellent light stability and permanent locked-in color.



PROTECTIVE COATING APPLICATION
The wooden hull of this handsome cabin cruiser is coated with GLIDPOL to provide maximum water and abrasion resistance, hardness and lasting high gloss.

All of your service and molding requirements can be met by one of the GLIDPOL family of polyester resins. GLIDPOL provides superior wetting of the glass fibers, maximum corrosion resistance to water and most common chemicals with uniform quality from batch to batch.

Glidden-controlled manufacture of GLIDPOL helps insure rapid, uniform cure at elevated or room temperatures without cracking or crazing. You can use GLIDPOL in your laminating, molding, impregnating, casting, potting and coating operations.

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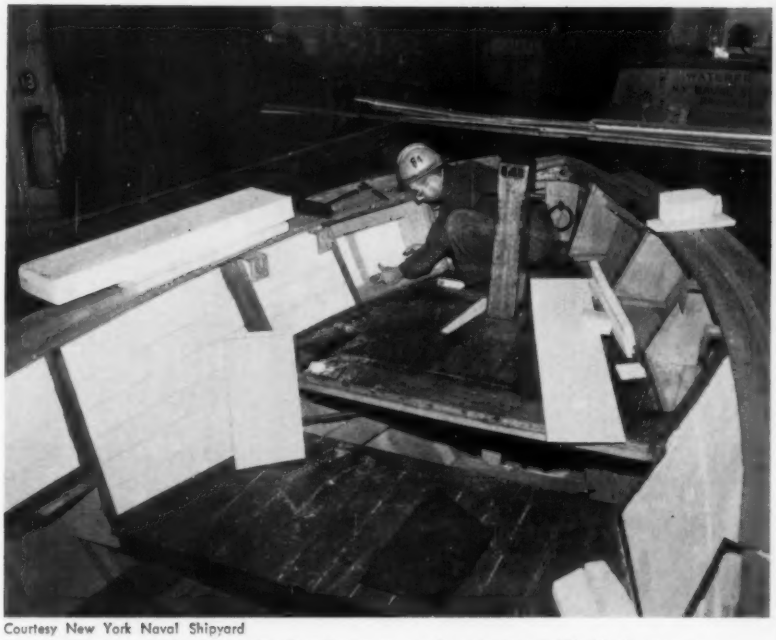


Courtesy New York Naval Shipyard

Small boat for the aircraft carrier *Bennington* is made virtually unsinkable by inserting blocks of expanded styrene foam sawed to size into the open wall sections

Styrene Foam Makes Boat Unsinkable

THANKS to the excellent flotation properties of expanded styrene foam, small boats can be made virtually unsinkable by inserting blocks of the foam material into all available open spaces.

The installation technique was developed by the U. S. Navy and is expected to be eventually adapted to the construction of most small boats in the fleet. Currently, work is underway at the New York Naval Shipyard on inserting the flotation material into the various small boats used by the aircraft carrier *Bennington*.

Original testing and developing of the application was done at the Boston Navy Yard. To determine the effectiveness of the styrene foam as a means of keeping small craft afloat under adverse conditions, boats were first lined with specified amounts of styrene foam and then flooded. The amount of foam necessary to make each boat unsinkable could thus be ascertained.

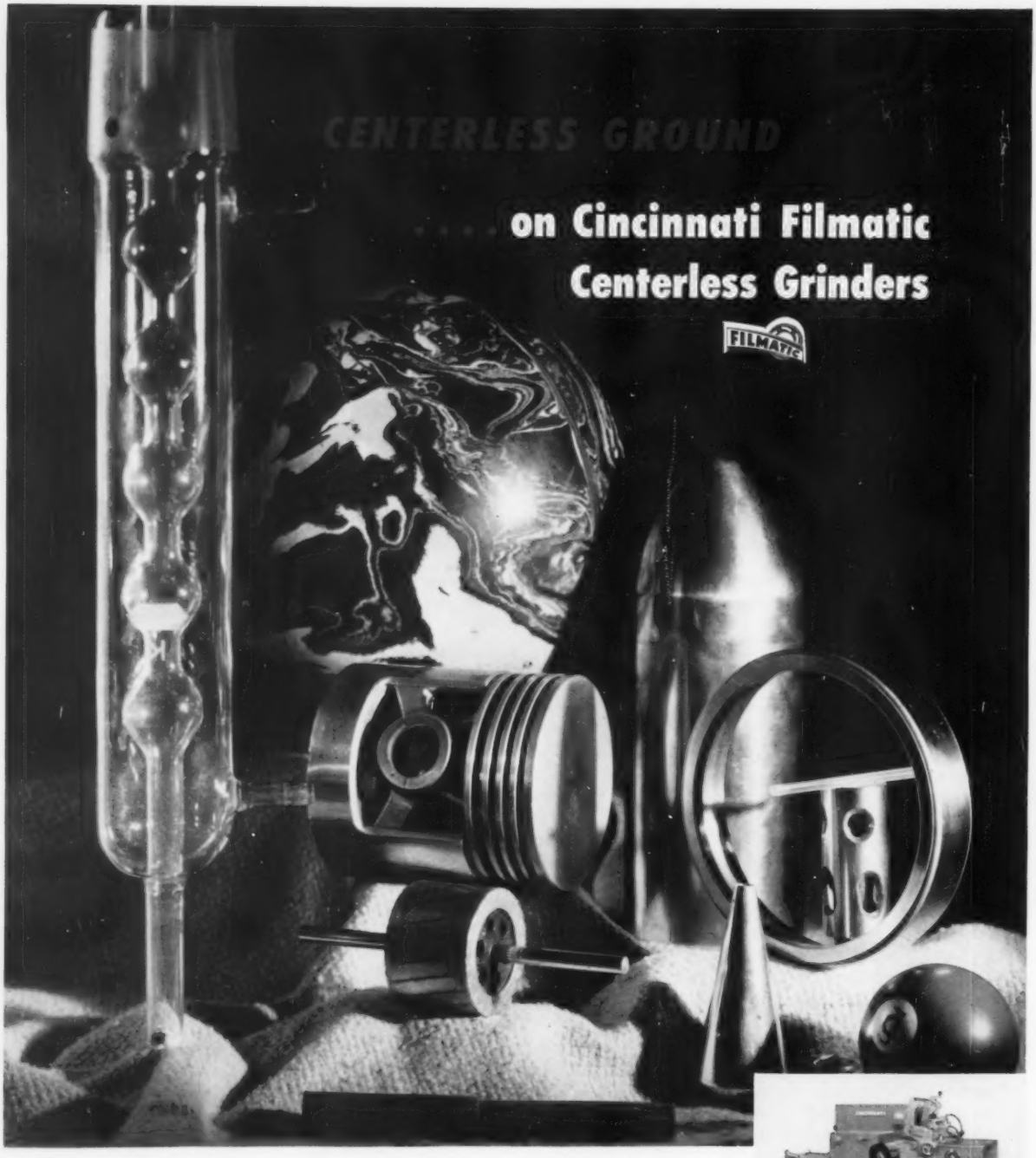
According to officials of the New York Naval Shipyard, the average small boat requires about 56 cu. ft. of the material to be kept afloat. Since most of the 28 different types of small boats which will eventually receive the foam do not have sufficient storage space to accommodate this amount of material, preliminary alterations are necessary before the flotation material can be installed.

Actual installation is a relatively simple job. The expanded styrene foam is supplied in the form of boards or rough planks. After the exact area into which the foam will be fitted has been determined, the plastic boards or planks are cut to size using conventional wood-working equipment. The foam is then manually inserted in the hull, primarily in the open spaces between supporting wall sections around the sides of the boat.

Because of the light weight of the multi-cellular foam—it weighs only about 2½ lb. per cu. ft.—the extra weight added to the boat by the liner is negligible and has little or no effect on the operation of the craft.

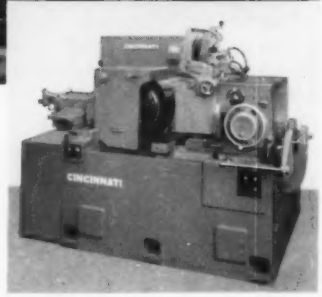
At the present time, Styrofoam 33 cellular material, a new formulation, is being used for this application. Styrofoam 33 has reduced burning characteristics and when tested in accordance with A.S.T.M. D 635-44, can be classified as "self-extinguishing."

CREDITS: Styrofoam 33 is supplied by The Dow Chemical Co., Midland, Mich.



Plastics are prominent in this illustration. These parts were Cincinnati centerless ground to extra high-quality finish and accuracy at negligible unit cost. Our engineers are experienced in tooling up CINCINNATI FILMATIC Centerless Grinders for work of this type. And it may pay you to talk to them about your parts or products made of plastics. Give us a call for a methods conference at your convenience. Meanwhile, write for literature.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO



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New CINCINNATI FILMATIC No. 2 Centerless Grinder. Catalog No. G-644. Other CINCINNATI FILMATIC Centerless Grinders suitable for plastics work: No. 0, No. 3, No. 4.

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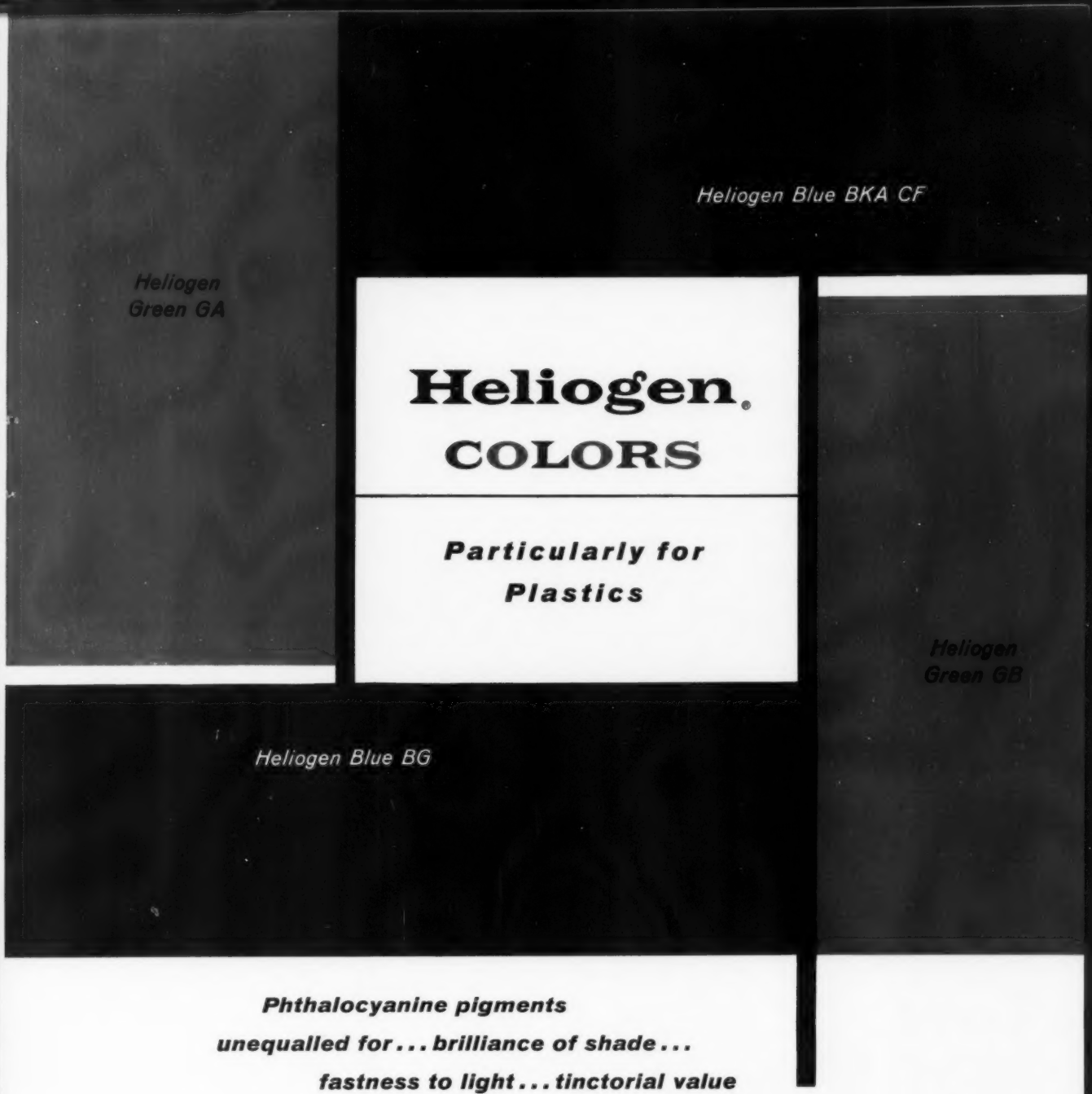

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Heliogen Colors are supplied in powder or presscake form—according to the user's requirements. Compounders of plastics—and particularly the Vinyl plastics—standardize on these colors for their ease of handling, their chemical stability and their brilliance. (This page was printed with inks made from the Heliogen Colors as indicated.)

The powders are noted for ease of grinding. The corresponding presscakes flush readily into the plasticizers normally used. All are non-crystallizing in the presence of aromatic solvents—with the exception of Heliogen Blue BKA Powder CF. All are relatively heat stable—particularly the Heliogen Blue BG Powder which is outstanding in this respect.

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Shipped in Film

DELICATE hybrid grass roots, bare of earth, are being successfully shipped in thin-gage polyethylene film containers, similar to the type used to package carrots and radishes, which serve as the inner bag of a new type of package, the outer part of which is a conventional open-mesh bag such as is used for onions or potatoes.

The container was especially designed for the product—Meyer Z-52 Zyosia, which is grown only from highly perishable roots. Previously, cardboard cartons had been used in which the grass was packed in the form of plugs consisting of tufts of grass, roots, and earth.

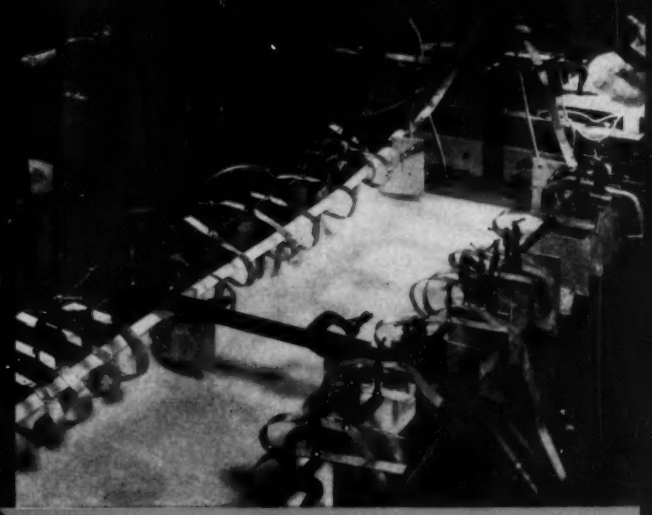
Now, because of the physical characteristics of the polyethylene film —its moisture resistance, its permeability to oxygen and carbon dioxide, and its light transmitting qualities—only the sprigs in bare-root form, without any earth attached, need be shipped. As a result, the same amount of grass that formerly went into a package weighing 28 lb. can now be shipped in a package weighing only 24 oz.—a weight saving of 94 percent.

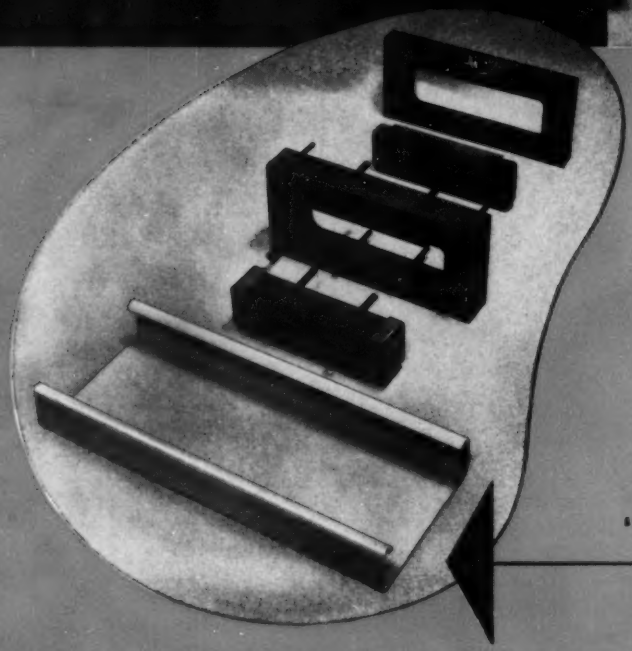
Grass stored in the protective bag will remain fresh and alive for 30 days when the package is placed in a cool area and for 60 days when put into a household refrigerator. The film that is used for the bag is 1½ mil thick.

CREDITS: Package was developed by the Chase Bag Co., Chicago, Ill. in cooperation with the Turfgrass Farm, Tucson, Arizona.

By packing grass in polyethylene bag, shipping weight is reduced 94 percent

At Plaskolite, Inc.
COLUMBUS, OHIO





Cascade
pre-hardened DIE STEEL at ROCKWELL C 35

"... filled our extrusion die needs perfectly"

Latrobe's Cascade precipitation hardened die steel was used for the large extrusion dies (shown above) by Plaskolite, Inc., Columbus, Ohio. These dies are used to extrude plastic diffusion plates for overhead lighting fixtures.

Plaskolite, Inc., found these three distinct advantages when using Latrobe's Cascade...

1. **No heat treating required after finishing—an advantage since close tolerances were required on these large extrusion dies.**
2. **Cascade's hardness (Rockwell C 35) is high enough to protect dies from damage during die changes.**
3. **Cascade's superior finish produces plastic extrusions with extremely high finish.**

The outstanding characteristics of pre-hardened Cascade have been noted by plastic mold makers everywhere... clean cut machined surfaces, free from tears, save costly bench cleanup time... uniform hardness even in large sizes—the result of Cascade's precipitation hardening property... plus outstanding polishing qualities. Call your Latrobe representative today.

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LATROBE STEEL COMPANY
LATROBE, PENNSYLVANIA

Pen, Pencil Parts

(*From page* 88)

tions motivate decisions on materials use. Economics are, of course, paramount. And design requirements are also basic motivating factors, as are the type of molding operation which the pen or pencil manufacturer has set up, the type of molds in which he has invested, and the color line he has planned or maintained over the years.

After all, there are pens and pencils that sell for 25¢ and there are pens and pencils that sell for over $25 . . . and there are plastics in all of them.

The following paragraphs list the writing instrument parts made of plastics, today, together with the various materials used and the reasons why they were selected. Where no individual company is named, the quoted statement is a composite of information obtained from several producers.

Barrels (fountain pens, ball point pens, pencils)

1) *Cellulose acetate*—(Scripto) "for color possibilities, for strength, and for the ease with which it can be lacquered when advertising message or company name is to be printed on the barrel."

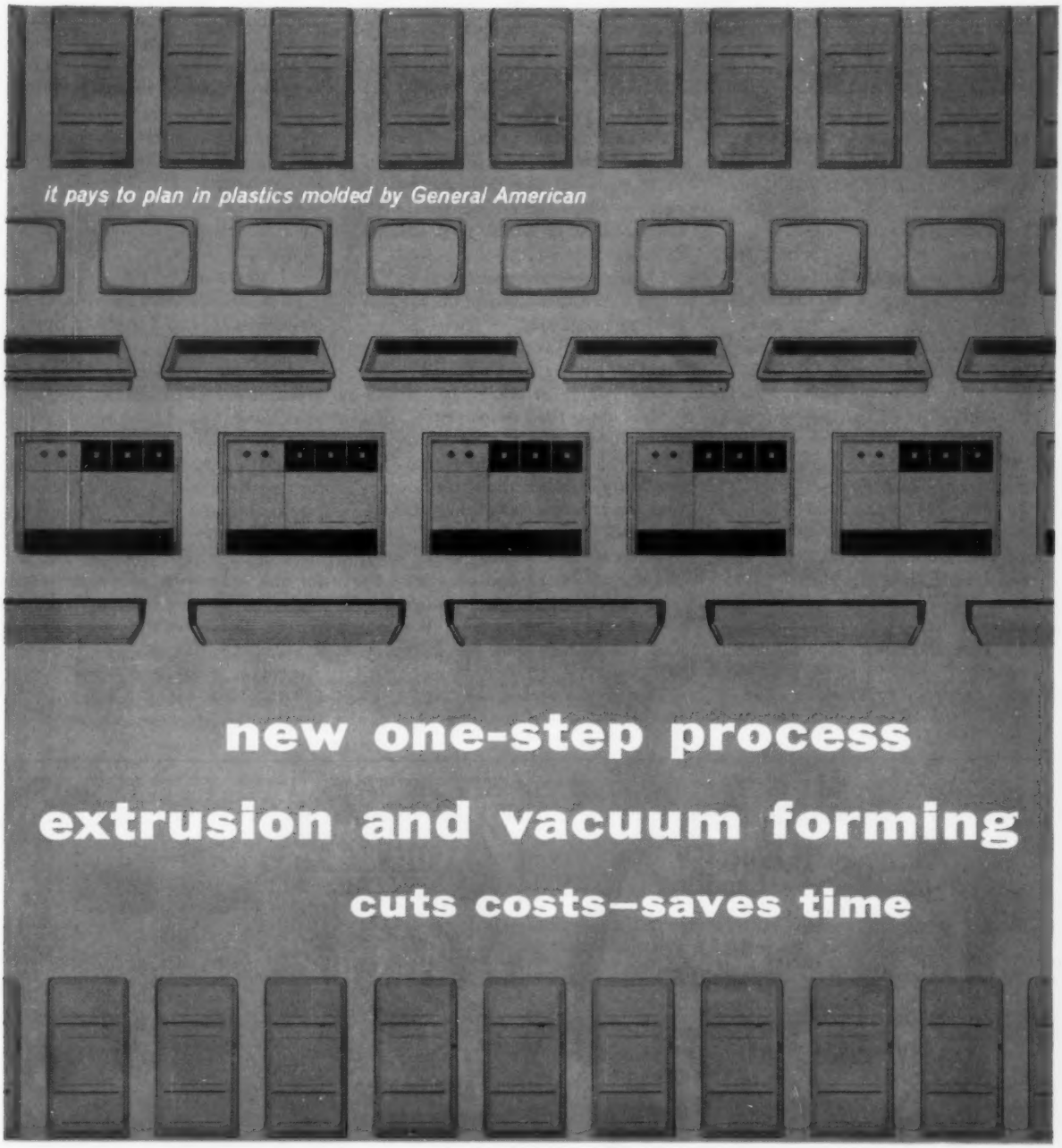
2) *Cellulose acetate butyrate*—"for ease of fabrication, for strength, for color possibilities, for dimensional stability, for resistance to aging, for high-gloss finish, and for ease with which it can be imprinted."

3) *Cellulose nitrate*—(Esterbrook) "for dimensional stability, for strength, and for the attractive geometric configurations and mottled effects that are possible."

4) *Nylon*—(Parker) "for high-impact strength, for resistance to weak acids and alkalies (perspiration from the hand), for wearing properties, for dimensional stability, for light weight, and for sales appeal inherent in consumer recognition."

5) *Phenolic*—(Autopoint) "for rugged strength, for high-gloss finish, and for the fact that it is less slippery and more comfortable to hold in the hand than metal."

6) *Polyvinyl chloride*—(Esterbrook) "for variety of color patterns possible, for lustrous surface finish, for non-flammability, for ease of



Refrigerator inner-door liners by the thousands, television-cabinet fronts, dresser drawers, air conditioner fronts, housings for lighting fixtures . . . these are just a few of the many parts that can be produced in one step at lower cost through General American's continuous operation extrusion and vacuum forming.

This General American process speeds production, permits lower tooling costs, more rapid tooling and quicker changeover. With General American doing your molding, you have no capital investment.

Can these advantages help you? It will pay you to find out. Investigate General American's unduplicated facilities for plastics moldings. Write for details.

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machining, for resistance to ink, and for dimensional stability."

7) *Styrene*—(Scripto) "for economy, for ease of molding, and for adaptability to precision fit."

8) *Styrene-acrylonitrile*—"for resistance to attack by ink, for scratch resistance, for lustrous finish, and for depth of color."

Caps (fountain pens)

With the exception of nylon and phenolic, same as for barrels.

Liners (for metal fountain pen caps)

1) *Cellulose acetate butyrate*—"for strength, for ease of machining, and for precision fit."

2) *Polyethylene* — (Esterbrook) "for resiliency which permits the liner to conform to the shape of the section for snug fit."

3) *Styrene-acrylonitrile*—(Scripto) "for resistance to ink and for good precision fit."

Sections (fountain pens)

1) *Acrylic*—(David Kahn) "for resistance to ink, for low moisture absorption, and for better holding properties."

2) *Polyvinyl chloride*—(Esterbrook) "for dimensional stability, for ease of machining, and for resistance to ink."

3) *Nylon*—(Sheaffer) "for elasticity to resist stresses during assembly of pen point and barrel."

Feeds (fountain pens)

(Hard rubber is still the major basic material for this application because of its dimensional stability, the fact that it "wets" well, and its chemical inertness.)

1) *Acrylic*—"for resistance to ink, for low moisture absorption, and for holding properties."

2) *Styrene-acrylonitrile*—(Scripto) "for strength, for rigidity, and for resistance to ink."

Cartridges (ball point pens)

1) *Polyethylene*—"for transparency, for chemical inertness, for flexibility, for low moisture absorption, and for 'non-wetting' characteristics." (See pp. 93-94.)

Internal mechanical parts (ball points and mechanical pencils)

1) *Cellulose acetate butyrate*—"for strength, for ease of molding and machining, and for precision fit."

2) *Styrene*—(Scripto) "for economy, for ease of molding, and for adaptability to mass production processes." (According to Scripto, which uses a molded styrene nut to replace a die-cast metal nut in one mechanical pencil model, "the styrene has sufficient tensile strength and is given an abrasive finish to insure precision fit.")

3) *Styrene copolymer*—(David Kahn) "for toughness and for the fact that it is less brittle than many other materials."

Push buttons (ball point pens and mechanical pencils) and **end buttons** (fountain pens)

1) *Acrylic*—"for stiffness, for dimensional stability, and for ease of machining."

2) *Cellulose acetate butyrate*—"For strength, for ease of molding, for matching color possibilities, and for lustrous finish."

3) *Nylon*—(Esterbrook) "for strength, for resistance to ink, and for the ease with which it can be dip dyed to serve as an indicating button to show the color of ink available in the pen or to match the colors of cap and barrel."

4) *Styrene alloy*—(Scripto) "for greater flex strength."—END

New Chapter

(*From pp.* 87-94)

resistant, and can be molded to closer tolerances.

When the pencil is assembled, the molded butyrate magazine is simply fitted into the upper half of the pencil barrel. A tiny metal gripper inserted into the magazine engages the molded-in threads and advances or retracts the leads.

The metal magazine previously used required complicated spiral wound tubing covered with a cylindrical sheath to accomplish the same thing. In addition, two metal separators press fitted into the sheath in the previous model to serve as a reservoir for leads are eliminated in the plastic version by a series of molded-in ribs.

Like so many other jobs done by Scripto in adapting plastics to pen or pencil, the 12-cavity mold for the butyrate magazine is an engineering marvel. Costing upwards of $20,000 to produce, the precision mold produces all slots, threads, ribs, and openings in the piece in a single shot. According to Scripto, the most difficult part of the mold design was engineering the 0.088-in. diameter threaded mandrel from which the plastic part is unscrewed as the mold opens.

Liquid Lead

Most exciting development in the pencil industry in years is the Liquid Lead pencil—and, of course, plastics are involved. Marketed by both Parker and Scripto, the Liquid Lead pencil works on the same principle as the ball point pen. Instead of containing ink, however, the Liquid Lead cartridge holds a supply of a fine graphite in a liquid suspension. The particles are fine enough to pass around the ball point, they make the same type of markings as a lead pencil, and it is claimed that the markings can be erased without difficulty with a conventional eraser.

Hopes of both companies are high for this product as a possible successor to pencils with solid lead. Basic contribution of plastics is in the form of barrels and caps molded to close tolerances. (See p. 94.) Scripto also makes use of a polyethylene cartridge in its Liquid Lead pencil.

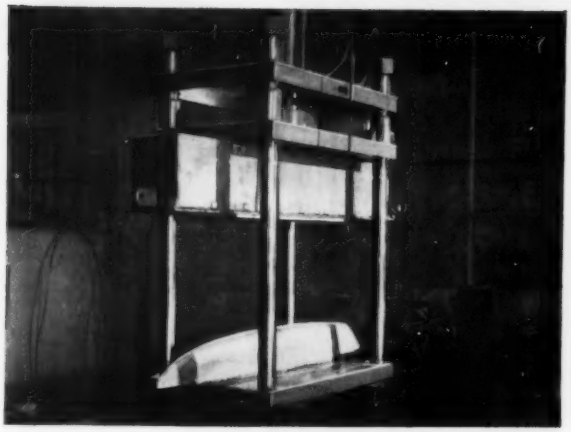
Desk Sets

In 1953, total combined sales of desk and dip pen sets amounted to approximately 1,843,000 units. Although this figure is considerably lower numerically than the number of pens and pencils sold in 1953, it is more impressive volume-wise than it appears at first glance. It is estimated, for instance, that about 3 lb. of plastics goes into the molding of caps and barrels for *1 gross* of pens; closer to 4 lb. if feed, section, and other internal components are added. For a desk set molded plastics may weigh ¼ lb. *each.*

Of all writing instruments, the desk set is also probably the most diversified user of plastics materials. Esterbrook's Auto-fill desk pen set is an example. The Auto-fill has a glass base which serves as a reservoir for the ink supply. The pen which stands up at an angle from the base fills by capillary action from this supply.

Six plastics materials contribute

users report big savings with sprayed metal tooling



Photos courtesy Narmco Mfg. Co., San Diego, Cal.

Typical glass laminated part produced from sprayed metal tooling in press shown. Match molds for this jet aircraft wing tip were built up with alternating layers of sprayed aluminum and bronze over sprayed zinc base and backed with copper tubing, reinforced and insulated with laminated glass cloth. Tubing carries steam for cure, after which cold water is used to chill male for next layup.

new bulletin provides data round-up on current successful applications

Reports from users of sprayed metal tooling on recent successful applications form the basis for a new data bulletin, now available without charge. These case histories demonstrate the substantial savings in time and money over other tooling methods, point up possible pitfalls that can be avoided in tool design and fabrication.


sprayed metal tooling

Data covers general procedures, describes and illustrates tooling now in use and plastic production parts. Write for a copy of this new data bulletin, or use the handy coupon below.

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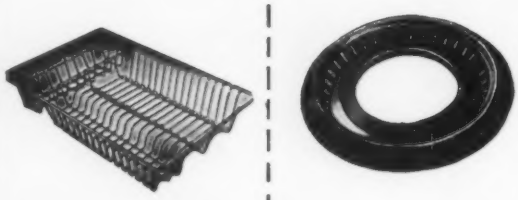
VINYL PLASTISOLS



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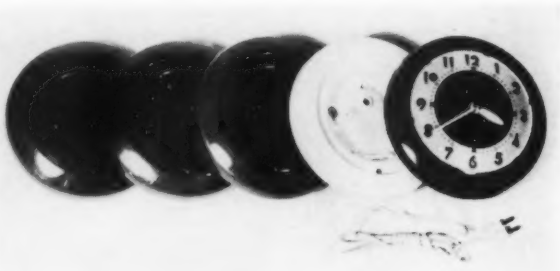

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to the end product: 1) a molded phenolic closure which fits over the glass base; 2) a molded styrene indicator ring which fits into the glass base to show just how high to fill the bowl; 3) a molded polyethylene capillary unit; 4) nylon monofilaments which function as the capillary agent; 5) a machined vinyl fountain pen section; 6) a machined vinyl fountain pen sleeve; and 7) a transparent acrylic pen taper.

Company Developments

According to one manufacturer, "the prime value of all this activity with plastics materials is that it is opening new markets for plastics in those pen and pencil components that have previously resisted their advances. The gripping sections of fountain pens, for example, which were still made of hard rubber even long after plastics had proved successful in barrels and caps, are now, in many instances, being molded of acrylic, nylon, or styrene-acrylonitrile, or machined from polyvinyl chloride."

Developments by eight leading manufacturers of writing instruments, as described below, lend weight to this observation.

Autopoint Co.—The original Autopoint pencil barrel was made of wood; it became shabby looking after a few weeks of use. In 1921, the company switched to a compression molded phenolic barrel, in which the various bores to accommodate the expulsion-retraction mechanism at one end and the spare leads at the other were molded in, eliminating expensive machining operations and reducing costs.

A later improvement was made by replacing the all-metal tip (which was a screw machine part or metal tubing swedged to a cone shape) with a compression molded phenolic cone.

Esterbrook Pen Co.—A pioneer in the industry since 1858, Esterbrook makes an extensive use of plastics in pens, pencils, and desk sets.

Esterbrook is one of the few companies still using barrels and caps fabricated of cellulose nitrate and practically the only one employing various vinyl components. Other uses of plastics include a molded polyethylene liner for metal caps; molded nylon end-buttons dyed red or black to indicate the color of ink being used or to match the colors used in barrels and caps; and desk-set bell holders molded of nylon or styrene-acrylonitrile. In the latter application, plastics replace stainless steel which, according to Esterbrook engineers, was not as ink resistant as the plastics and did not afford as good a seal.

Esterbrook also makes desk set bases formed of styrene copolymer sheet or molded of phenolic.

Eversharp, Inc.—One of the first manufacturers to adopt plastics for internal parts of writing instruments, Eversharp has done considerable work in adapting polyethylene to the manufacture of ball point ink cartridges. The other major material in the Eversharp line is cellulose acetate butyrate, but several new models incorporating parts molded of styrene, acetate, and nylon may be introduced in the future.

David Kahn, Inc.—Marketing its products under the trade name of Wearever, David Kahn, Inc., is one of the country's large manufacturers of ball points in the $1 price cate-

gory. Major material in the company's plans is cellulose acetate butyrate for barrels, caps, mechanical parts, buttons, and, in transparent, as a holder for metal ink cartridges and as a reservoir for leads in mechanical pencils.

The company is also one of the largest users of molded acrylic sections, feeds, and buttons and is one of the few manufacturers using a ball point pen bushing molded of modified styrene copolymer.

The Parker Pen Co.—In its "51" line of pens, Parker uses machined cast acrylic barrels and shells, a styrene nipple, a vinyl ink sac, and an ethyl cellulose inner cap. With the exception of barrel and shell, which are molded of acrylic and with the addition of an acrylic feed, the same plastics materials also go into the design of the "21" line.

From the plastics standpoint, however, one of the most interesting models in the Parker line is the Jotter ball point pen—the first pen to use a molded nylon barrel. The Jotter also incorporates a molded nylon ratchet whose function is to distribute wear on the ball point and ball seat by rotating the seat 90 degrees every time the button on the bottom of the pen is pushed. To insure success, a material was required that was light in weight, had good wearing properties, and was self-lubricating—and nylon filled the bill.

Scripto, Inc.—Regarded as one of the country's most progressive manufacturers in the engineering of plastics parts for fountain pens, ball point pens, and mechanical pencils, Scripto has found use for plastics in every model in its line. The company is probably the largest user of molded styrene in the industry and absorbs a considerable amount of acetate, butyrate, and polyethylene as well.

Estimated consumption of plastics by Scripto in 1955 is tabulated as follows:

Styrene	444,860 lb.
Styrene copolymer	8,320 lb.
Acetate	381,290 lb.
Polyethylene	217,100 lb.
Butyrate	246,740 lb.
TOTAL	1,298,310 lb.

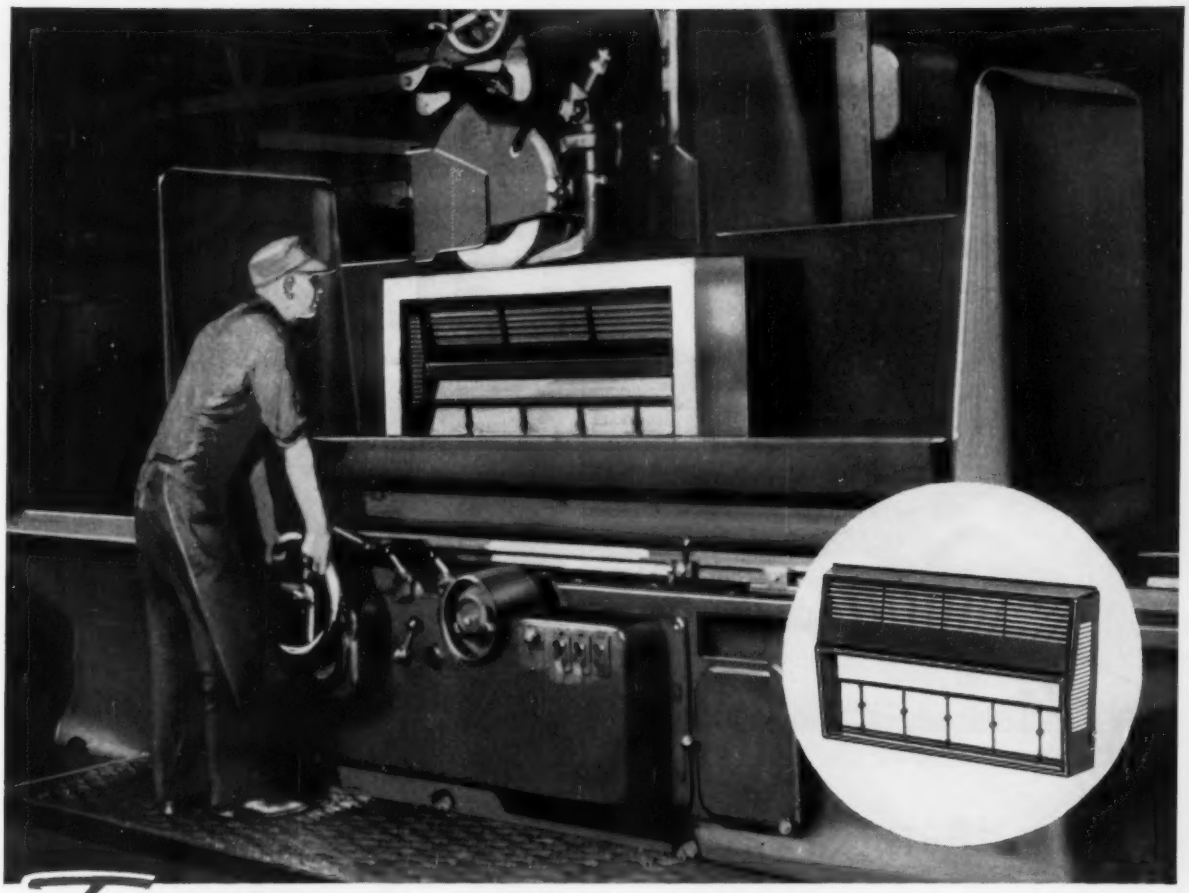
Innovations include an irradiated polyethylene tip for an ink cartridge (see p. 91), an internal connection for a ball point pen molded of styrene alloy (chosen because of exceptional flex strength), and the butyrate lead magazine described on p. 94.

W. A. Sheaffer Pen Co.—Working with plastics since as far back as 1921, Sheaffer is still ranked as one of the largest volume users. Since most production is centered around the Snorkel pen (see p. 93), molded styrene-acrylonitrile parts represent most of this volume. The company also makes use of molded nylon O-rings and point holders, molded styrene copolymer gripping sections, and various minor styrene, acetate, and butyrate parts.

Waterman Pen Co., Inc.—As described on p. 93, the plastics "big four" in the manufacture of Waterman's C/F pen are polyethylene, styrene-acrylonitrile, polyvinyl formal, and butyrate. Other models in the Waterman line have cast acrylic bands and buttons and molded butyrate cap liners.

Because of such extensive use of plastics, it is natural that most of

(*To page* 220)



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COMPARISON OF PROPERTIES: MORFLEX P-50 VS. COMPETITIVE PRODUCTS

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		Product A		Prdouct B		Product C		Product D	
	50 PHR	*65 PHR*	*50 PHR*	*63 PHR*	*50 PHR*	*75 PHR*	*50 PHR*	*65 PHR*	*50 PHR*
Modulus 200	2325	2175	3150	1850	2925	2625	3200	2550	2950
Tensile	2800	2975	3500	2525	3325	2900	3450	2925	3275
% Elongation	235	28	220	310	215	235	200	265	240
Shore Hardness	90	90	100+	88	100+	90	100+	90	100+
Brittle Point, °C	−15	−15	+20	−8	+5	−14	0	−18	−5
After 7 days @ 100°C:									
Tensile	2850	3125	3400	2725	3250	3025	3500	2975	3475
% of Original	101.8	105.0	97.1	107.9	87.7	104.3	101.4	101.7	106.1
% Elongation	245	270	210	280	220	215	180	240	195
% of Original	104.2	96.4	95.5	90.3	102.3	91.5	90.0	90.6	81.3
After 7 days @ 121°C:									
Tensile	2700	3250	3625	2900	3350	3150	3750	3100	3975
% of Original	96.4	109.2	103.6	114.9	100.8	108.6	108.7	106.0	121.4
% Elongation	250	260	200	270	190	205	145	205	105
% of Original	106.3	92.9	90.9	87.1	88.4	87.2	72.5	77.4	43.8
Loss in Water:									
10 days @ 25°C	−0.5	−0.3	−0.1	−0.9	−0.5	−1.4	−0.5	−0.8	−0.3
Loss in Oil:									
10 days @ 25°C	0.0	−0.1	0.0	−1.9	−0.7	−1.2	−0.4	−2.1	−1.2
Loss in Soap:									
10 days @ 25°C	−0.5	−0.2	−0.1	−3.1	−0.9	−2.1	−0.9	−1.3	−0.8
Loss in Air:									
10 days @ 25°C	0.0	−0.4	−0.1	−0.9	−0.6	−1.1	−0.8	−1.7	−1.0
Volume Resistivity of Plasticizer Ohm—Cm × 10"	0.68	0.81		0.85		0.93		1.21	
SIR Megohms—1000' @ 60°F	56,000	8,700	12,100	9,700	11,100	1,700	1,800	235	300
SIC	5.8	7.6	7.4	6.9	7.2	7.3	7.1	8.1	8.4
% PF	10.2	8.2	7.9	7.8	8.0	8.9	8.3	10.9	10.3

MORTON-WITHERS CHEMICAL COMPANY

Greensboro, North Carolina

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Paterson, N. J.

The Caldwell Company
94 Cutler Parkway
Akron, Ohio

the manufacturers of pens and pencils have set up their own molding departments and, where barrels are still being machined from rod stock or tubing, suitable facilities for such operations. Injection or compression molding, however, are at present almost universally used by pen and pencil manufacturers, primarily because of adaptability to mass production processes and the fact that they eliminate the high scrap losses attendant on machining parts from plastics sheets or rods.

In addition, most current manufacturers of writing instruments have fully equipped finishing departments in which all degating, drilling, buffing, and hot-stamping operations are performed on the molded parts.

The present trend, however, is toward eliminating as many of these finishing steps as possible by designing plastics components that are ready for assembly just as soon as they are molded. Consequently, most molds are designed to produce all necessary slots, openings, threads, etc., and to provide automatic degating. In all cases, the gates are kept as small as possible. Weigh feeders are extensively used on injection machines.

As one engineer at Eversharp described this trend, "today, the design of the pen mechanism must satisfy the design of a fully automatic mold to produce it before it is acceptable."

All of this means, of course, that the investment of pen and pencil manufacturers in molds runs high: some companies have as many as 30 to 40 different models in their lines and each model requires different plastics parts. David Kahn, Inc., for example, estimates that at the present time over 100 molds are in stock, ranging in cost from $4500 to $15,000. The company further estimates that it has spent more than $½ million on molds during the past ten years.

Future Developments

Development of modern writing instruments has taken place within the past 40-year period that coincides with the introduction and growth of plastics. That the newer plastics may be even more important to the future of the pen and pencil industry—and vice-versa—is implicit in this report.—END

Plastics Signs

(*From pp.* 96-99)

terial is molded in sheets 9 by 8 in. in size and 0.070 in. thick and in sheets 3 by 4 in., 0.044 in. thick. Steel rule dies are used to cut the letters out of the sheet. For some applications, the front of the reflecting acrylic sheet is coated with moisture-resistant silicone that makes the sign doubly effective in rainy weather.

The signs have been in use on some roadways for 7 to 10 years without any reports of failure.

Reinforced Plastics

Relative newcomer to the highway sign field is the polyester-fibrous glass laminate. Reinforced plastics signs have only been on the market for about three years and most of the installations have been of the experimental type described above. From the standpoint of weather resistance, strength, minimum of maintenance required, light weight, integral color, and ease of production, however, the three-year field tests have proved so successful that the manufacturers of such signs feel that the field is going to expand tremendously within the next few years.

Attesting to this confidence is the growing number of fabricators that are entering the field. Included among current manufacturers are such well-known names in reinforced plastics as: Chemold Co., Santa Monica, Calif.; General Tire & Rubber Co., Akron, Ohio; Perry Plastics, Inc., Erie, Pa.; Swedlow Plastics Co., Los Angeles, Calif.; and Winner Mfg. Co., Trenton, N. J.

The hopes of these manufacturers run high. Perry Plastics, for example, which supplies signs to all 48 states and even to several foreign countries, reports a very high percentage of repeat orders indicative of a high degree of customer satisfaction. Some of Perry's signs have successfully been in use for more than three years.

Winner reports that over 2000 of their signs are seeing service on highways in New Jersey, Pennsylvania, and Virginia as a replacement for easily chipped porcelain enamel steel signs. And General Tire & Rubber Co., Akron, Ohio, recently announced the receipt of an order

for 10,000 reinforced plastic State and Federal marker shields from the State of Virginia Department of Highways. These rugged new signs will be used by Virginia in an effort to cut down the $40,000 spent annually on replacing metal signs destroyed by vandalism. Prior to the decision to adopt the shatterproof, rustproof reinforced plastic shields, the signs were subjected to months of extensive wear, during which they were exposed to varying weather and climatic conditions, including the biting salt spray found along coastal highways.

Production Processes

Most of the reinforced plastics signs are matched metal molded. Differences exist, however, in the method of applying the legend to the face of the sign.

Perry Plastics, for example, silk screens the legend on the face of the sign with weather-resistant inks. The sign itself, which is about ⅛ in. thick, is molded in polished steel molds in a high-pressure hydraulic press and cooled on an aluminum slab. Perry produces the signs in rectangular shapes, as well as in the octagonal (STOP sign) shape.

At Winner, the legend is first printed on a specially treated paper and the paper is then laminated between the fibrous glass mats. Swedlow employs a similar process in which cloth or paper silk screened with stable inks or paints is laminated between the surfacing layers of fibrous glass cloth.

From the standpoint of reinforced plastics usage, it is interesting to note that the success of the highway signs has aroused interest among the commercial sign people who produce not only the spectacular billboard type of sign but small warning or informative type of signs.

A small STOP-SLOW hand sign of this type is being made by Swedlow Plastics for use by construction workers in the Division of Highways of the State of California. The reinforced plastics sign has proved especially ideal for this application because of its light weight for easy handling.

Another development which resulted from the work on the reinforced plastics highway signs is a reinforced plastic light barrier being made by Winner. These barriers are

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simply panels of translucent polyester-fibrous glass laminate set at an angle along the separating strip of a divided highway. Their function is to diffuse light from the headlights of cars on one side of the highway so as not to blind approaching cars on the other side. At the present time, the baffles have been installed experimentally on a 500-ft. length of the Garden State Parkway in New Jersey.

Formed Vinyl Signs

The newest additions to the highway sign field are markers formed of rigid vinyl sheet. Just how far this application will go and how fast is still up for debate. Some manufacturers feel that the publicity on this item is well ahead of the production and economics and that much work has to be done before the application will be competitive; others maintain that it is going to realize its potential within a very short time.

But both sides agree that it is an excellent product with a very bright future. At the present time, tests are being conducted on the signs by the cities of Barberton and Akron in the State of Ohio.

The signs for this test installation were fabricated by Seiberling Rubber Co., Akron, Ohio, using Geon vinyl supplied by B. F. Goodrich Chemical Co., and are intended to replace conventional metal signs.

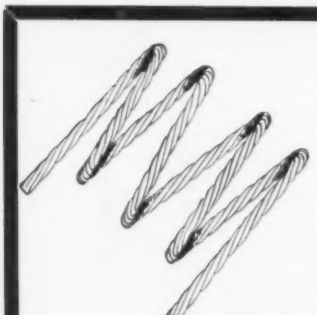
The durable markers will not chip or rust and will last many years longer than metal signs with little or no maintenance. They are unaffected by sun, rain, snow, or temperature changes and are formed with three-dimensional lettering that is easy to read. They can be bent and will snap back to their original shape when the tension is released. Metal signs, which have only an approximate three-year life, have to be discarded if bent.

Of interest to game hunting states where extensive damage has been done by hunters' rifle target practice, is the resistance to shattering shown by the vinyl signs. In a series of tests conducted on the signs, 10 holes were shot into a STOP sign from a distance of 60 ft., using .22 caliber long rifle ammunition. The holes on the entrance side of the vinyl sheet were the size of the bullets, but the rigid vinyl had closed in on the exit side leaving only holes about the size of a wooden match stick. There was no shattering evident and the holes were difficult to see at all from a distance.

This habit of shooting at highway signs by cowboys, hunters, and youngsters is, oddly enough, the most acute maintenance problem faced by Western states and the demonstrated effectiveness of the rigid vinyl signs should do much to advance plastics highway sign applications.

It is reported that in one Rocky Mountain state, tests are also being conducted on the possibility of adapting formed styrene copolymer sheet to the application. As was the case for vinyl, a major advantage of the rugged styrene sheet, in the event that it is shot at, is that it does not have a tendency to feather out as is the case with metal signs punctured by bullets.

The signs all point in one direction—plastics are on the road to a fabulous new market and are approaching it at high speed.—END



Design Awards

(*From p. 102*)

to Federal Tool Corp., Chicago, Ill., for a handsome two-tone, drop-door breadbox molded of high-impact styrene. As recipient of the scholarship award, Federal Tool selected the Illinois Institute of Technology.

Honorable mention awards in this division were given to Meridian Plastics, Inc., Byesville, Ohio, for a combination indoor-outdoor thermometer molded of heat-resistant styrene for the Thermometer Corp. of America, Springfield, Ohio, and to Autograf Brush & Plastics Co., Inc., New York, N. Y., for a towel holder molded of heat-resistant styrene for Scott Paper Co., Chester, Pa.

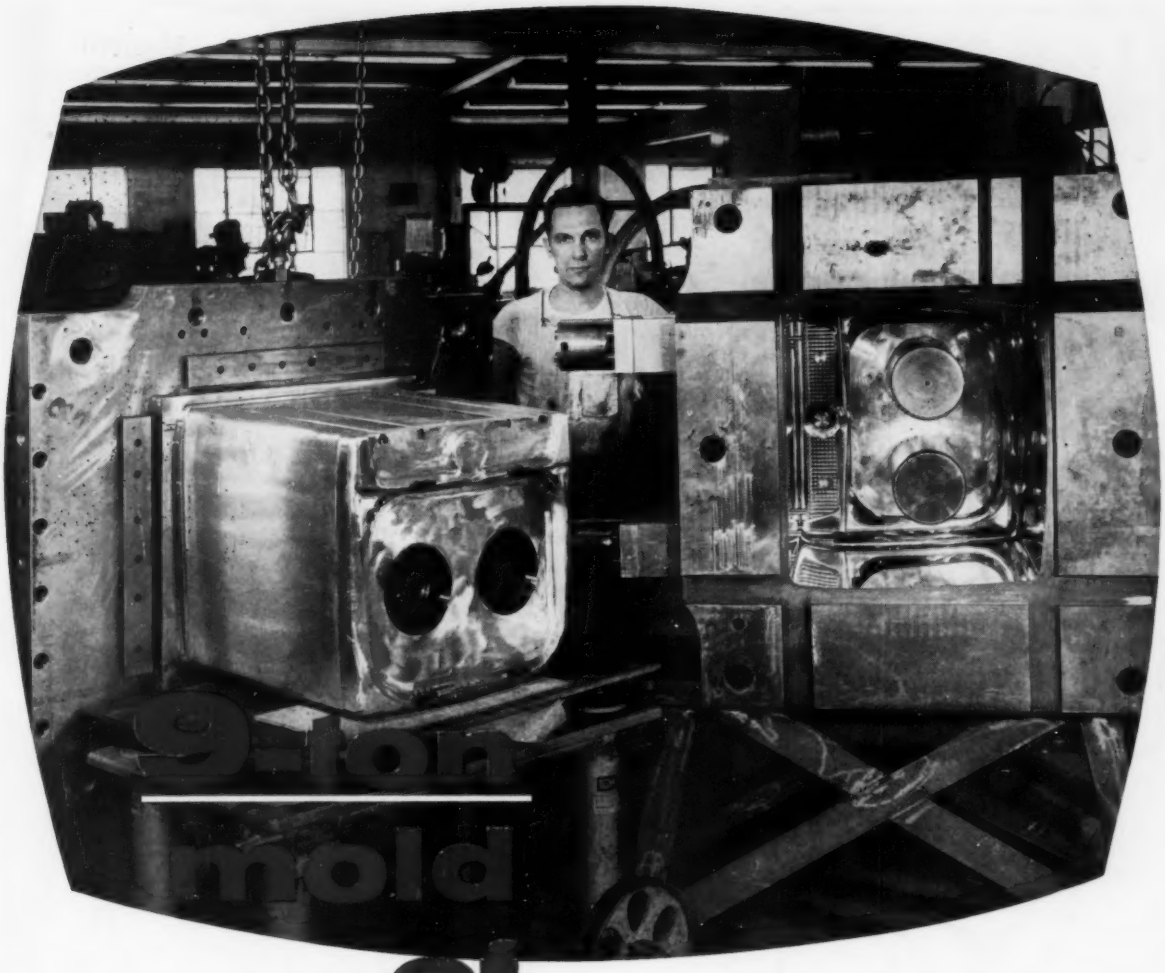
In the category dealing with utilitarian products with non-operative construction features, first prize was awarded to Burroughs Mfg. Corp., Los Angeles, Calif., for an 18-piece starter serving set of Luau dinnerware molded of styrene in two-color combinations. For its scholarship award, Burroughs named the Carnegie Institute of Technology.

Honorable mention awards in this second classification went to Gits Molding Corp., Chicago, Ill., for a set of insulated tumblers molded of high-impact styrene and to The Plas-Tex Corp., Los Angeles, Calif., for an 8-piece salad set.

Winner in the third category—decorative products with or without operative construction features—was Injection Plastic Corp., Skokie, Ill., with a glossy, rectangular styrene shelf planter trimmed around its base with gold. Recipient of this company's scholarship award was The University of Illinois, Urbana, Ill.

The third division's honorable mentions were awarded to Polycraft Corp., Div. of American Plasticraft, Chicago, Ill., for a frame placque with black lattice background and white bas-relief figures, all molded of high-impact styrene, and to Quality Molding Co., Chicago, Ill., for a wick-type, self-watering planter molded of styrene.

All the awards were presented at a banquet held in the William Penn Hotel, Pittsburgh, Pa. Guest speaker at the affair was Clare E. Hodgman, Raymond Loewy Assoc., who spoke on "The Role of Plastics in Product Design."—END



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Vinyl-Metal

(*From pp.* 107-111)

machine is being engineered to provide wider material. Automotive parts, home appliance components, and machine housings are the first market objectives.

Roll-Coater, Inc., Pendleton, Ind., is another laminator working from coiled strip metal, using a 60-ft. oven and chilled drums instead of a water spray for cooling. At the present time the width lamination is 12 in. but again a facility for wider material is being prepared.

A-Jay Specialty Co., Naugatuck, Conn., is laminating vinyl to sheets of steel, brass, aluminum, copper, and magnesium on a machine which can handle 2700 sq. ft./hr., and proposes to move into coil strip lamination within the next few months.

Pittsburgh Steel Co., Pittsburgh, Pa.; Jones & Laughlin Steel Corp., Pittsburgh, Pa.; Acme Steel Co., Chicago, Ill.; Seiberling Rubber Co., Akron, Ohio; and American Nickeloid Co., Peru, Ill. are all in process of installing equipment under the "Marvibond" license arrangement. Others working on the laminating process are the Metal Purchasing Co., New York, N. Y., and Eastern Venetian Blind Co., Baltimore, Md.

While it is certain that enormous and stable markets exist for the vinyl-to-metal laminates, the complete picture will not be seen until a lot of study has been given to the metals and the plastics involved, until design engineering data are more firmly established, and until means are developed for using such standard metal fabricating methods as spot welding. Properly made, the laminate has a bond strength greater than the tensile strength of the vinyl sheet. Properly made, the total laminate will stand continuous temperatures up to 250° F. Made with almost all standard metals, and handled with care, the laminated product can be sheared, crimped, bent, drilled, and punched with standard tools.

It appears likely that not many captive facilities will be built because the specialized nature of many of the applications will probably require versatile custom laminating plants. It appears likely also that future expansion will be mainly through companies experienced in the use of metals.—End

One-piece Hull

(*From pp.* 112-114)

counting dies, the investment to make a 17- to 18-ft. lap-strake hull will run about $250,000. The dies will probably cost between $100,000 and $125,000.

The question of economics of this process, compared to other methods of making fibrous glass-reinforced plastic boat hulls, is, of course, very important. The other methods are: 1) hand lay-up; 2) vacuum bag; 3) pressure bag; 4) the Marco process.

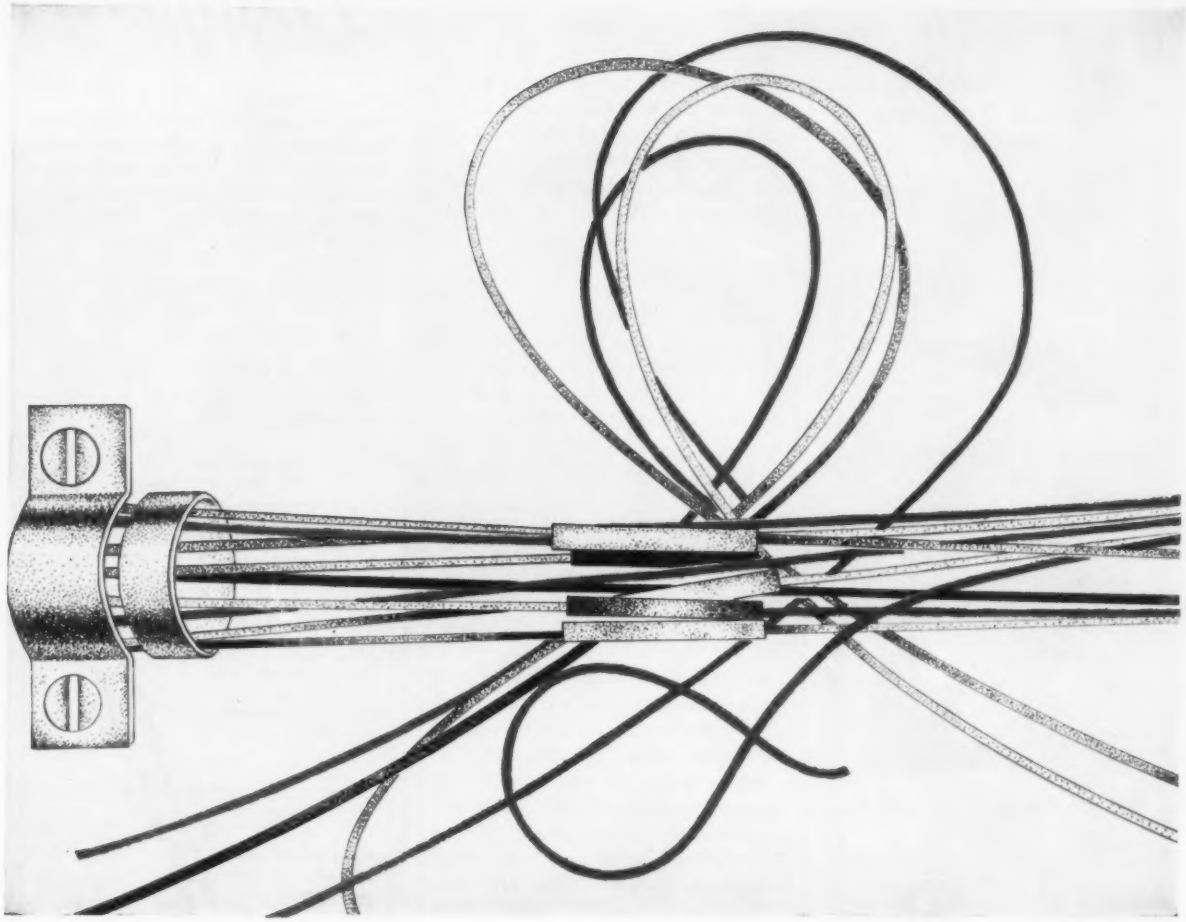
None of our companies has ever done any production work in these processes. Our only experience with them is with the costs that were incurred in making hand lay-up and vacuum-bag molded parts for the sports car before matched metal dies were ready. That experience showed that large hand lay-up parts cost about three times as much as large matched metal die parts and that large vacuum-bag molded parts cost over twice as much. With small parts, the comparative cost differential is even greater.

This boat hull will sell to the boat builders at a price of approximately 70¢ per pound, not including tool amortization, which will add $15 to the cost of each hull. The cost is higher than normal for large simple parts because of the use of overlay mat and 4½% white pigment; also, the special resin used is more expensive than standard resins. Since thickness can be kept more constant in matched metal dies, and since glass content can be much higher, these hulls should be much stronger in relation to weight.

The Prospects

Fibrous glass-reinforced plastics have proved so superior to other materials for fishing rods that now between 80 and 90% of all rods are made of this material. Reinforced plastics delivery truck trays handle over 50% of all commercial bread baked in this country. Reinforced plastics are so superior to any other material used for boat construction in their physical properties, and lend themselves to mass production with consequent economies so well that we expect that over 50% of all boats below 16 ft. in length will be made of this versatile material five years from now.—END

Why does man use color



IDENTIFICATION OF PLASTIC-INSULATED WIRE

Red means danger, pink is for girls, purple was royal, the Irish wear green. Color, of course, is an excellent visual means of identification. That is why the electrical industry codes wiring by incorporating various pigments into the plastic insulating material.

Acheson supplies wire and cable coaters with code colors predispersed in the usual coating resins, as well as dispersed blacks for protection against light deterioration.

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DISPERSIONS FOR THE PLASTICS AND PRINTING INK INDUSTRIES

Heating Cylinder

(*From pp.* 127-139)

wall temperature.) Also, while injecting, the shot just introduced into the chamber, being unmelted, is responsible for most of the pressure loss. Proof of this argument is given by a comparative test of two cylinders, one of which has an extended cylinder, and one of which has not. There is no significant difference in pressure loss (Fig. 17, p. 139).

One effective method of reducing this granular zone pressure loss is by prepacking; that is, moving the shot into the cylinder *under pressure* immediately after the previous injection. The shot then soaks during the mold-closed and mold-open parts of the cycle, and a layer of molten plastic forms at the wall, reducing the pressure loss (Fig. 18). A similar result may be obtained by preheating of the granules.

Conclusions

In conclusion, it can be said that the pressure loss is reduced most effectively by: 1) careful design of the torpedo nose; 2) using as high a temperature as possible in the "granular zone" of the chamber; 3) adequate torpedo heat; and 4) packing the charge into the chamber and/or preheating the granules.

These experimental results show that careful design will improve heating chamber performance without sacrifice of essential qualities. There are, to be sure, many questions left unanswered, but it is hoped that the data presented here will not only be helpful to the injection molding machine manufacturer and molder, but will also encourage them to conduct similar experiments with their own heating cylinders. The results of such work will give a lot of information on the design of heating cylinders and methods of improving them.

Acknowledgments

The authors wish to express their appreciation to Watson Stillman Co., Reed Prentice Corp., Hydraulic Press Mfg. Co., Lester Engineering Co., Moslo Machinery Co., and Fellows Gear Shaper Co., for their cooperation in providing equipment and heating cylinders for the experimental work performed in the preparation of this report.—END

Color Differences

(*From pp.* 143-146)

between curves requires extended experience. Such differences are illustrated in Fig. 4, p. 144, by curves for two yellow samples. One of these samples appears darker than the other. However, if the curves were used by a person having limited experience, it would not be possible for him to tell whether there were other differences. There is a need for some type of short-hand designation of color and color differences. This designation must be in terms that have visual meaning.

Integration of spectrophotometric curves by the CIE system provides this information. The Librascope Integrator attachment for the G. E. Recording Spectrophotometer performs the integration automatically. The resulting data are identified as tristimulus values X, Y, Z. These values represent primaries that are theoretical colored light sources. The primaries cannot be produced in a practical manner, but they are parallel to red (X), green (Y), and blue (Z) colors.

Chromaticity Diagrams

These primaries do not lend themselves to direct interpretation in terms of common experience, but a system that does can be derived from them. As intermediate steps, trichromatic coordinates x, y, and z are determined as follows:

$$x = \frac{X}{X + Y + Z}$$

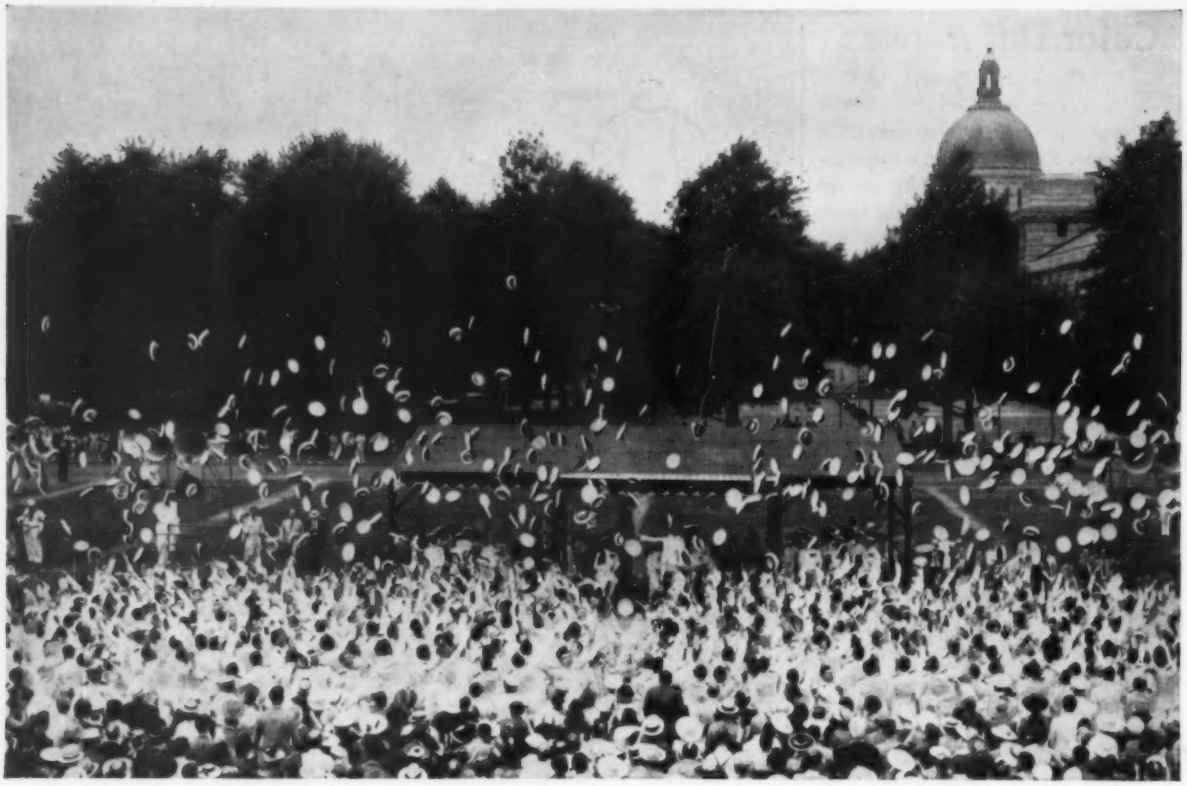
$$y = \frac{Y}{X + Y + Z}$$

$$z = \frac{Z}{X + Y + Z}$$

Since $x + y + z$ equals unity, only two of the values are independent; x and y are used. Y which measures lightness (lightness or darkness) is used with x and y for the coordinates of a color solid.

If the coordinates x and y are determined for the spectrum colors and plotted, their locus forms two sides of a triangular-shaped figure. The line joining the ends of this locus represents non-spectrum colors. These colors are defined from

(*To page* 239)



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RIVETERS. Literature gives details of "Airflex" pneumatic riveters, said to be suitable for use on fragile materials. Specifications and case histories are presented. Lemert Engineering Company, Inc. (F-502)

CAVITIES AND CORES. File folder gives detailed information for making the master hobs used in production of "Hi-Pressure-Cast" beryllium copper cavities. Recommended methods of heat treating and machining the cavities are also presented. Process Mold Company. (F-503)

POLISHING AND BUFFING OF PLASTIC. Article discusses when and how to perform each of the following finishing operations: sanding, polishing or wheel sanding, ashing, and cut-down and luster buffing of thermosetting plastics, plastic laminates, and thermoplastics. The Lea Manufacturing Company. (F-504)

PLASTICS MATERIALS. Brochure describes properties and applications of molded and extruded "Teflon" (high temperature, high frequency, chemical applications), "Rulon" (bearings, bearing surface applications) and "DL-1-Teflon" (similar to Teflon, lower in cost). Dixon Corporation. (F-505)

ELECTRIC HEATING UNITS. Comprehensive manual on selection and use of heating elements. Includes specifications and prices of company's full line of strip, cylindrical, grind, cartridge, tubular and immersion heating units. Describes heater controls and accessories. Also gives engineering data, charts, tables. Watlow Electric Manufacturing Company. (F-506)

BLENDERS AND MIXERS. Illustrated folder gives specifications and descriptions of following equipment: crushers, mills, dry batch mixers, batch blenders, air separators and vibrating screens. Company's engineering services are also described. Sturtevant Mill Company. (F-507)

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RELEASING AND BACKING PAPERS. Illustrated file folder describes new line of parchment papers, having excellent releasing action from tacky and sticky surfaces. Among uses: strippable protective backing for sheet and film, wall tile, pressure sensitive tapes. Samples included. Paterson Parchment Paper Company. (F-515)

CUSTOM MOLDER AND FINISHER. Illustrated folder gives step-by-step description of mold-making, molding, decorating, fabricating and finishing services available from this custom injection molder. The Jamison Plastic Corporation. (F-516)

SPRAY METALLIZING OF PLASTICS. Leaflet describes process for depositing a mirror-like finish on prepared plastic surfaces. Several advantages are explained. Jems Chemical & Supply Company. (F-517)

RADIANT HEATING PANELS. Literature shows and describes two models of "Thermomat" radiant heaters. Several operating advantages are mentioned. Thermomat Company, Inc. (F-518)

CUSTOM FABRICATION. Booklet describes company's facilities for extrusion, injection, and fabrication of plastics materials. Photos of many samples are shown. Also contains a page of general reference information. Yardley Plastics Company. (F-519)

PLASTICS SUPPLIER. Folder gives detailed specifications and prices of acrylic, acetate and vinyl materials available in sheet, tube, and rod form. Almac Plastics, Inc. (F-520)

DECORATING PROCESS FOR THERMOSETS. Literature gives details about new process for the lithographic decoration of compression molded pieces. Subjects discussed include the process, its cost, and marketing possibilities. Einson-Freeman Company, Inc. (F-521)

FLEXOGRAPHIC PRINTING PRESS. Brochure contains features, operating characteristics, and shows photos of flexographic press for multi-color printing of plastic film, acetate material and cellophane. Wolverine Paper Converting Machinery Corporation. (F-522)

PLASTICS FABRICATING. Brochure describes company's custom fabricating services: forming, printing and die cutting, machining, and design and assembly. 18 actual jobs are illustrated and described. Printloid, Inc. (F-523)

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WOODEN SHELLS, ROLLS, CORES. Leaflet gives photos and descriptions of a line of wooden cylinders for film handling, made in lengths to 11 feet, diameters 1½ inches to 16 inches. A variety of tubes and end caps is available for standard or heavy duty service. Cylinder Manufacturing Company. **(F-530)**

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PLASTIC-TO-METAL ADHESIVE. Sheet describes two high tensile strength adhesives for hot bonding plastic sheet to cold rolled steel. Detailed application and drying instructions are given. Angier Products, Inc. **(F-534)**

PANEL SAW. Illustrated sheet gives description, specifications, applications, and suggested mounting method for "Model MLR-614" long rail panel saw, designed for accurate cutting of high pressure laminates. Hendrick Manufacturing Corporation. **(F-535)**

EPOXY TOOLING RESINS. Booklet describes varied line of epoxy tooling resins and suggests applications. Several special purpose resins are also mentioned. Furane Plastics, Inc. **(F-536)**

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their complementary spectrum colors which lie across the figure from them. They are maroons and purples. Reference to Fig. 5, p. 144, will indicate the locus of spectrum and non-spectrum colors on the chromaticity diagram. The chromaticity characteristics of all possible colors can be represented by different points within this figure. The division of the chromaticity diagram according to the common hues is included in Fig. 7, p. 144.

The chromaticity diagram is used to obtain two descriptive color terms which when coupled with the Y value (lightness) define the position of a color in the color solid. These coordinates are an intermediate step in the determining color terms related to human experience.

The descriptive color terms that parallel human experience are dominant wavelength, lightness, and purity. They are related to the trichromatic coordinates and Y values. For instance, when considering Fig. 6, p. 144, which is a diagrammatic sketch showing the relationship of the neutral axis and the chromaticity diagram, the neutral axis is vertical and perpendicular to the chromaticity diagram. The extremities of this axis correspond to white at the top and black at the bottom, with the positions between corresponding to a graded series of grays. Grays, black, and white are referred to as neutral colors since they do not reflect any hue selectively. There are an infinite number of steps between black and white; each step marks the vertical position of a chromaticity diagram of a specific lightness or darkness. The intersection of the neutral axis with any chromaticity diagram is called the neutral point.

A non-neutral color will lie between the neutral point and the periphery of the chromaticity diagram. A line drawn from the neutral point through the point indicating the color intersects the periphery of the chromaticity diagram at a point corresponding to a definite wavelength. This is known as the dominant wavelength of the color. Figure 8, p. 145, illustrates the colors of the different areas of the chromaticity diagram. The ratio of the distance from the neutral axis to a point representing a color to the distance from the neutral axis to the periphery is determined and expressed

as a percentage. This value is known as the color purity. Zero percent color purity represents a neutral color such as a white, black, or gray, while 100% color purity represents a spectrum color. Figure 9, p. 145, illustrates the position of a series of colors having the same dominant wavelength but different color purities on the chromaticity diagram. The color solid is made up of an infinite number of such figures perpendicular to the neutral axis. The location of a particular figure on the neutral axis is determined by the Y value. This value is known as "lightness" and is expressed as a percentage. Zero percent on the scale indicates a black and 100% a white. An illustration of a variation of lightness along the neutral axis is illustrated in Fig. 10, p. 145. Detailed data for obtaining the above three values are given by Hardy (1).

Cataloging Colors

The applications of color measurements are numerous. A filing system based on three color dimensions was visualized by Ingle (2). Such a system offers an orderly means of locating a colored sample with a minimum of effort. It is very useful to individuals who must have an accessible catalogue of a large number of colored samples.

This color solid file can be visualized as a cabinet containing 60 drawers, i.e., ten drawers high and six drawers wide. This is illustrated diagrammatically in Fig. 11, p. 145. The width of the file represents dominant wavelength, height lightness, and depth color purity. Thus, the first vertical row of drawers contain all colors having dominant wavelengths that are described as violets. The dark violets (those having a small value of lightness) would be at the bottom of the file. Those having a high value of lightness would appear at the top. Continuing toward the right the same is repeated for hues of blue, green, yellow, orange, and red. In any drawer the colors would be arranged according to color purity. The weak colors, those nearest to the neutral colors, are filed in front of drawer; strong colors, those nearest to spectrum colors, are filed at the back.

This system would index each new color in reference to those which are available. If it were used as an aid to color matching, each new match

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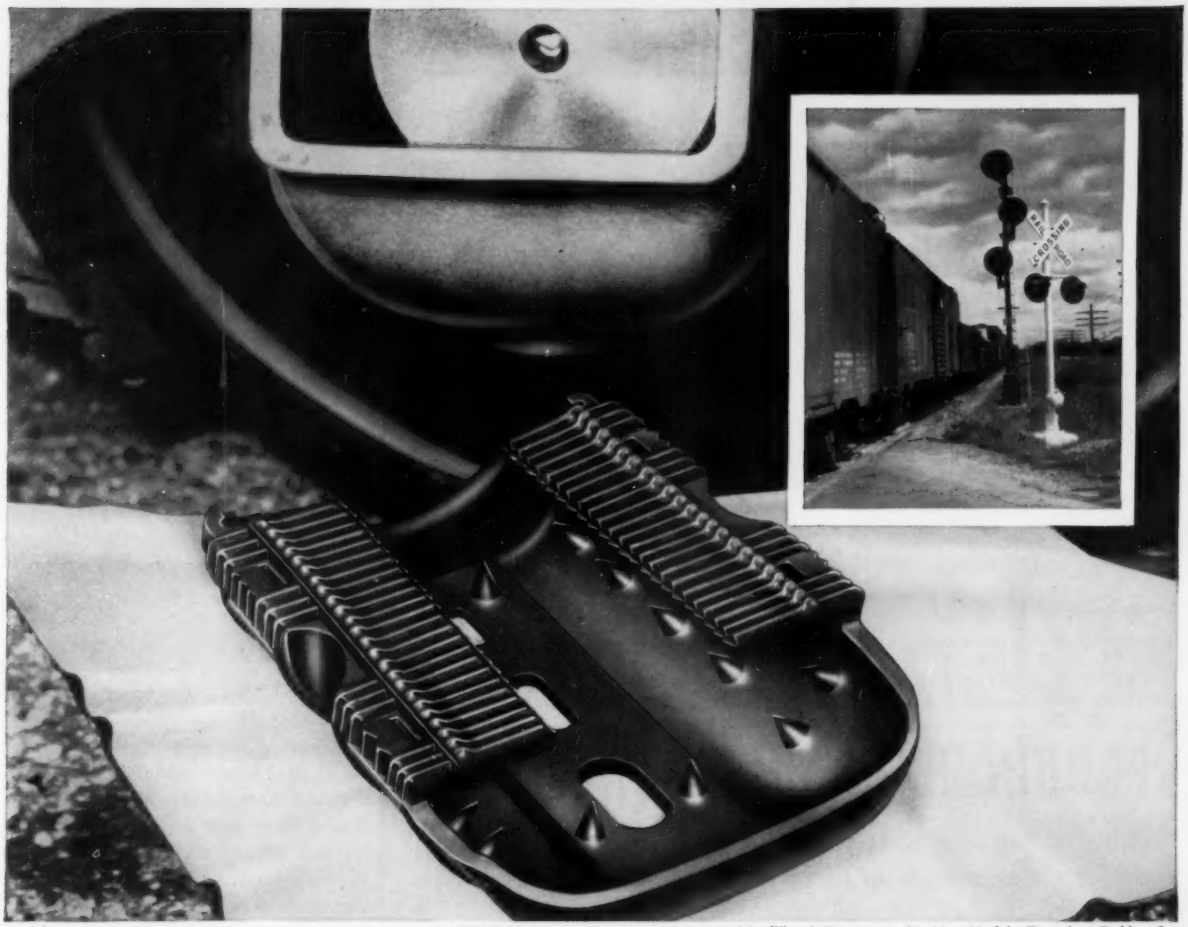

PLYPAK waste retainer manufactured for Waugh Equipment Co., New York by Davidson Rubber Co., Boston, Mass. B. F. Goodrich Chemical Company supplies only the Hycar rubber used in manufacture.*

HEAT'S OFF HOT BOXES!

ASK any railroader about "hot boxes"—overheated freight car journals—and he'll tell you they cause delayed schedules, repairs, even derailments. Losses run into the millions yearly. No easy problem to solve—but a manufacturer did it with a waste retainer molded from a compound employing Hycar American rubber.

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would be an asset and not a liability. When an unclassified system is involved, the multiplicity of colored samples generally leads to chaos.

Color Differences

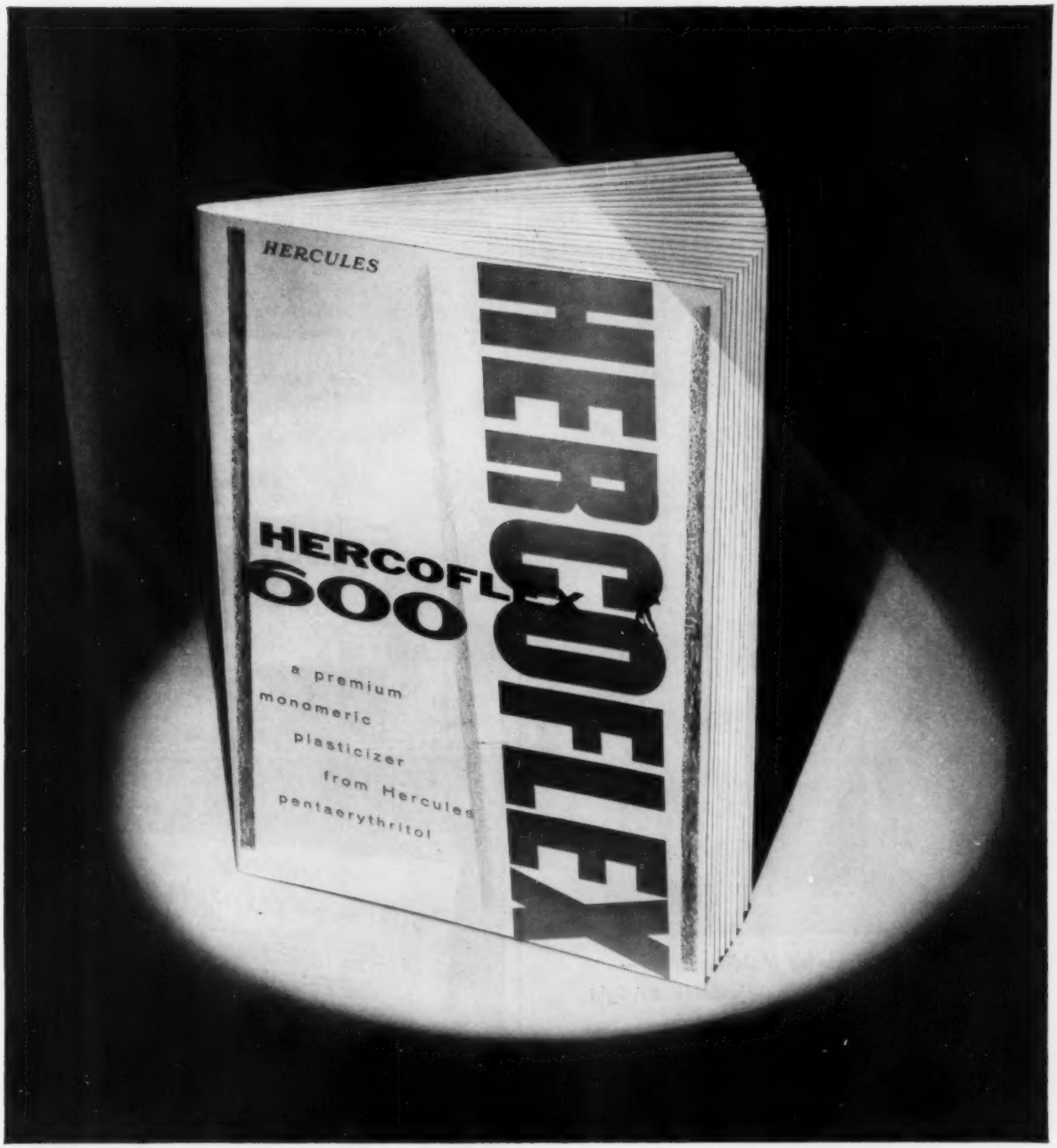
A second application of the CIE system is its use in determining color differences. Direct application of the system is simple, but it has one major disadvantage: in different portions of the color solid a fixed linear distance does not represent the same visual difference. It is possible to compensate for this lack of homogeneity by the use of correction techniques.

It is first necessary to establish a unit of color difference measurement. This is provided by the use of small change in color which is defined and established as a "Just Noticeable Difference Unit"; it is abbreviated JNDU. The magnitude of this unit of color difference is established experimentally in the following manner. The illustration is made with neutral colors in Fig. 12, p. 146. Consider a perfect black and a perfect white. Comparison of these colors side by side leaves no doubt that they are different. If a gray of half the difference is introduced, a difference is still noticed between the two samples. However, if this process is repeated numerous times, there will come a time when no difference can be detected between two samples. The step just previous to this point is considered as a "Just Noticeable Difference."

In the range of neutral colors from black to white an inexperienced observer can distinguish 180 differences. An experienced observer can distinguish 320 differences. An average of the two values, or 250 differences, has been selected as realistic compromise. The basic work for these observations was done by Munsell, Sloan, and Godlove (3).

The chromaticity diagram has been surveyed in a similar manner by MacAdam (4). His information indicates that the locus of one just noticeable unit in the chromaticity diagram is an ellipse. The size and inclination of the ellipse in the chromaticity diagram depends on its position, as shown in Fig. 13, p. 146.

The shape of the figure defining a "Just Noticeable Difference" in the color solid is a solid figure called an ellipsoid. It is convenient to represent this ellipsoid by the use of



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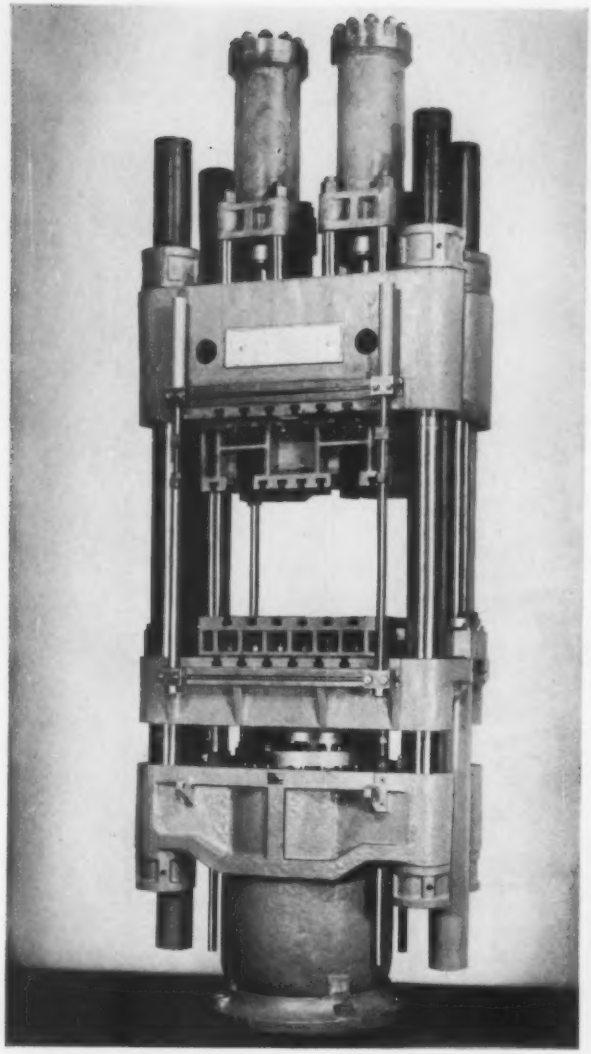

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orthographic projection. In this manner the ellipsoid is defined by three plain figures, generally ellipses which are determined from the top and two side views of the ellipsoid. An illustration of such an orthographic projection is given in Fig. 14. The center of the ellipsoid represents the aim color, and the distance between this center and the surface of the ellipsoid represents one just noticeable difference.

In practice the color difference data can be calculated from the orthographic projections. To determine the color difference between an aim color and a color differing slightly from it, the second color is plotted on each of the projections and the distance between the two points is determined in relation to the magnitude of a "Just Noticeable Difference" in each projection. If the distance determined from the top view and the two side views are represented as a, b, and c, respectively, then the color difference is

$$\text{Color Difference} = (0.707)\sqrt{a^2 + b^2 + c^2}$$

These orthographic projections of color data can be used to define color changes in a manufacturing process. It is possible to follow a trend and correct it before it becomes objectionable from a visual standpoint.

At the present time many color limits are defined by actual samples which are accumulated during a period of production. By using the CIE system, a tolerance of one, two or three "Just Noticeable Differences" can be established for any aim color. Then any color deviation of future production can be plotted and determined in relation to the aim color. All possible variations would be treated and the limits could be determined on a consistent basis. Under the old system of physical limits, this is not always possible since the variations illustrated by the retained limits might not cover a new excursion of the sample.

A set of samples illustrating light, dark, yellow, and blue limits for a green vinyl formulation are shown in Fig. 15, p. 146. CIE data were determined for these samples and plotted in Fig. 16, p. 146. This plot represents a small area in the chromaticity diagram. It is interesting to note that one of the common inconsistencies of visual limits is illus-

(*To page 248*)

trated by this group of samples. Here the blue limit is darker (indicated as a lower lightness or Y value) than the dark limit. In practice visual judgment often evaluates a material for its outstanding characteristics and does not consider some of its other characteristics. Although this sample is darker, it looked blue, and only blueness was considered. Although the CIE data results in a self-consistent limit, it also can be used to define inconsistent limits.

The color differences illustrated by the preceding example have been deliberately exaggerated for purposes of illustration. In actual practice this technique was applied to the control of a green plastic formulation. In terms of color dimensions this aim was described as a color having a dominant wavelength of 504 millimicrons, a lightness of 33.6%, and a purity of 6.6 percent. Different production lots were made subsequently and their variation is illustrated in Fig. 17, p. 146. The results of this color control are best characterized by the customer who is quoted: "We have been unable to establish limits for this color because it has not varied enough from lot to lot to produce any limits."

Other applications include the maintenance of colored standards which may drift on storage and for studies of the aging of materials over long periods of time. In addition to these measurements the system can be used for checking lot-to-lot variability of colorants.

In summation it is possible to make routine quantitative color measurements that can be related to visual judgments. A calculating device called an integrator makes routine CIE determinations economically feasible. These color data can be transmitted over a telephone. Ultimately, physical standards may be dispensed with.

References

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3. A. E. O. Munsell, L. L. Sloan, and J. H. Godlove, J. Optical Society of America *23*, 394 (Nov. 1933).

4. D. L. MacAdam, "Visual Sensitivity to Color Differences in Daylight," J. Optical Society of America *32*, 247 (May 1942).—End

Viscosity Stability

(*From pp.* 148-154)

Table IV. While varying the type of filler produced the greatest differences in absorption values, the plasticizer system does have a slight effect as evidenced by the lower absorption of DIDP than DOP. These differences in absorptions are minor and contribute only slightly to the viscosity build-up of plastisols. The important effects are the type of filler used and the solvating action of the plasticizer.

Effects of Extender Plasticizers

Secondary plasticizers, such as HB-20 and HB-40 (aromatic hydrocarbons), can be advantageously employed in minor concentrations to obtain lower viscosity and prolonged shelf-life at reduced cost. It must be remembered, however, that caution is to be used when formulating with secondary plasticizers so as not to create the more serious problems of incompatibility, high volatility, and poor heat and light stability. In certain applications, though, the inclusion of these extenders can be both economical and convenient. The viscosity measurements of DOP plastisols extended with these materials are listed in Table II. There it is shown that the viscosity performance of these products is more important at the lower storage temperatures, i.e., 25 and 40°C. But at 50°C. the mixed plastisols do not survive, whereas those containing DIDP or DIDA as sole plasticizers do.

Also included are the viscosity values for dispersions containing DOP in combination with Aroclor 1254 and 5460 (chlorinated polyphenyls) as extender materials. These products, although not as efficient in viscosity depression and stability as HB-20 and HB-40, have nevertheless found application in vinyl dispersions because of their adhesive and flame retardancy properties.

Commercial plastisols normally contain other additives that may have a significant effect on viscosity and viscosity stability. These include heat and light stabilizers, viscosity suppressants, and wetting agents. Some of these additives are also valuable for lowering and controlling viscosities. However, they generally are added in minor concentrations because of untoward effects of greater percentages. While they are useful, a plasticizer system selected to give optimum flow properties will reduce the burden carried by viscosity controllers.

Summary and References

In summation, evidence has been presented to show that diisodecyl adipate and diisodecyl phthalate can be very useful for imparting low viscosity and excellent shelf-life to vinyl plastisols. It is also indicated that DIDP can be advantageously mixed with other plasticizers for imparting special properties.

Table IV—Absorption of Plasticizers by Fillers (Gardner-Coleman Test)

	Amount of plasticizer absorbed (g./100 g. filler)					
Filler	*DOP*	*DIDP*	*S-141*	*S-160*	*DIDA*	*HB-20*
Atomite	38	35	41	41	35	41
Surfex	28	25	27	27	25	27
Barytes	14	14	15	15	13	16
#33 Clay	67	62	67	67	60	68

1. H. S. Bergen and J. R. Darby, Ind. Eng. Chem. *43*, 2404 (1951).

2. J. R. Darby and H. S. Bergen, Tappi *37*, 145A (1945).

3. H. Green, "Industrial Rheology and Rheological Structures" (1949). New York: John Wiley and Sons.

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6. H. A. Gardner and G. G. Sward, "Physical and Chemical Examination of Paints, Varnishes, Lacquers and Color" (1950). Bethesda: Henry A. Gardner Laboratory, Inc.—END

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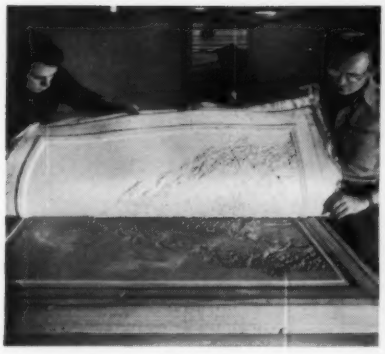
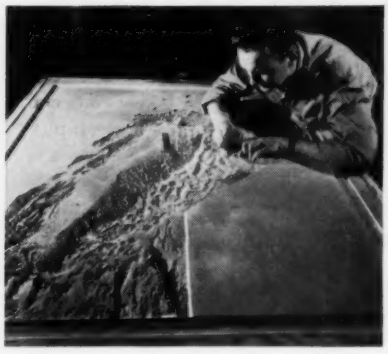
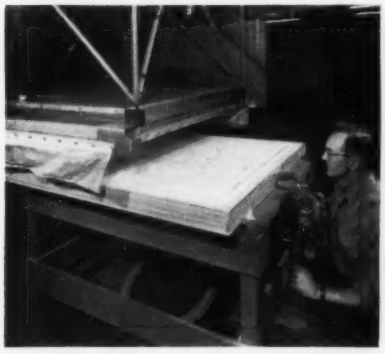


Largest commercial survey firm in the world, Aero Service Corp. of Philadelphia has photographed and surveyed over 2,000,000 square miles of the earth's surface. Here a rubber mold (made from an aluminum master) is used to make the Densite gypsum plaster mold on which the relief map will be proof formed.



Dimensional stability of the mold material is critically important in proof forming these relief maps, and few molding compounds are successful. Says the Manager of the Relief Model Division, "We have shifted to Densite exclusively . . . we know of no other plaster that can match it for proof forming."

In vacuum forming the plastic maps, a large number of .030" holes are drilled through the Densite mold. "With other plasters tested we have found it difficult to drill these small holes . . . With Densite there's no problem, it's a simple matter to get good, clean holes in a relatively hard material," Aero says.



Heating element moves in over the plastic sheet. A vacuum is created through the drilled holes, forming the plastic sheet in the contour of the Densite mold. With 15 pounds of pressure being exerted on each square inch, a 4′ x 6′ mold must withstand a weight of 51,840 pounds on its total surface.

The test sheet of plastic is checked for molding accuracy. With acceptable tolerances as low as .020", few molding compounds are suitable. The frequent heating and cooling cycles subject the mold to great thermal shock. The mold life of Densite is longer than that of any comparable product tested.

The finished plastic relief map is peeled off the Densite plaster mold. Aero Service Corp. concludes, "We find that Certain-teed Densite plaster is superior when it comes to recording detail . . . We like the fine surface of the Densite mold, which records every single detail of our aluminum masters."

All photos courtesy Aero Service Corp., Philadelphia

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Radiation Effects

(*From page* 159)

species in quantities capable of detection by chemical means.

Several methods for investigation of the chemical activity resulting from γ-radiation have been explored: 1) determination of intrinsic viscosity when the polymer is dissolved in inhibitor-containing solvent; 2) measurement of polymer formation at 25° C. when monomer is added to irradiated polymer; and 3) measurement of polymer formation at 70° C. when monomer is added to irradiated polymer exposed to air subsequent to irradiation. Certain *a priori* considerations, such as 1) the fact that ordinarily even a highly evacuated system may contain more oxygen molecules than the maximum possible number of free radicals, and 2) the high probability that immediately upon solution radicals will react with each other, would seem to render detection of radical activity extremely unlikely. Nevertheless, effects are observed that are indicative of the presence of free radical activity in irradiated polymers.

Effect of High-Energy Radiation on the Vibration Characteristics of High Polymers, *by C. D. Bopp and O. Sisman, Oak Ridge National Laboratory.*

The vibration characteristics were measured for certain irradiated elastomers and vinyl chloride polymers. The very small displacements used fulfill the assumptions made in elasticity theory for calculating the dynamic Young's modulus and the viscous modulus. For vinyl chloride polymers the direction of the radiation-produced change in Young's modulus is governed by the pre-irradiation rigidity of the polymer. For the more rigid polymers, it is increased; for the less rigid polymers, it is decreased.

The Young's modulus is changed primarily by the cleavage and cross-linking processes. Since the volume decrease that accompanies cross-linking is by a diffusional process, a rate-determining factor for cross-linking is the glassy type of rigidity which results from a low rate of diffusion. Rigidity also results from cross-linking to a network structure. The cross-linking-produced rigidity

has small influence on the rate of cross-linking.

Volume change resulting from the cleavage process is usually small. Though the rate of cleavage is low for glassy materials, it shows small rigidity dependence for less rigid materials. In materials with the structure of the unmodified paraffin chain, cross-linking is predominant. Cleavage is predominant in certain materials in which the paraffin chain is modified (e.g., by the substitution of chlorine in the case of vinyl chloride polymers).

A Cellophane-Dye System Dosimeter for High-Range Radiation, 10^5 to 10^7 Roentgens, *by Ernest J. Henley and David Richmond, Department of Chemical Engineering, Columbia University.*

It has been shown that dye reduction by gamma radiation is proportional to the concentration of unreduced dye left in a system. This paper considers the results of a set of experiments investigating the mechanism and cellulose degradation of such a cellophane-dye system.

Cobalt sources of 200 and 800 curies, spent fuel elements, as well as a Van de Graaff accelerator of 2-m.e.v. maximum energy and an X-ray unit, have all been used in these studies. In all experiments, the change in percent light transmittance with total dose was linear (of constant slope); the slopes plotted, however, varied with rate and energy of radiation. This rate and energy dependence has been investigated by means of the Van de Graaff and X-ray units. Rates used were from 5×10^4 to 10^6r./hour.

The effect of temperature was investigated with one of the cobalt sources. A change in transmittance due to the degradation of cellophane by heat was found; it was further found that 2×10^3 r. caused sufficient degradation to make the cellophane as brittle as when the material was subjected to heat for a long period of time.

Property Changes in Polyethylene Induced by Radiation, *by Quintin P. Cole, Chemical and Metallurgical Div., General Electric Co.*

The irradiation of polyethylene with high-energy electrons causes the formation of cross-links with resultant gelation of a portion of the polymer. The size of this portion and the consequent changes in behavior of the polyethylene are a function of the irradiation dose. The relationships between irradiation dose and several properties in the irradiated material have been studied.

Measurements of changes in gel content have been made and the strength of heat seals has been determined for films with varying irradiation dose. Heat seals have been found to show evidence of a decrease in strength with decreasing soluble fraction.

Polyethylene film that has been oriented during or after extrusion has a tendency when heated to change toward the dimensions that characterized it prior to orientation. This reversion is reduced by irradiation. The effect of irradiation has been studied, including the variables of method of orientation, degree of orientation, irradiation dose, and procedure for relaxing the oriented film.—End

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NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. Van Boskirk

Itaconic Acid

MAYBE not the most sensational but certainly one of the most interesting chemicals for plastics is itaconic acid, recently announced as available in large quantities by Chas. Pfizer & Co., Inc., 630 Flushing Ave., Brooklyn 6, N. Y. The acid has been available for years but in such small quantities and at such high cost that it has not been practical for adoption to plastics. It cannot be produced synthetically in large quantity, but Pfizer has now found a new way to produce the material from earth mold and molasses in large quantities that sell for about 60¢ a lb. in carload lots. Company officials believe that it will compete with the lower priced petrochemicals, will give superior properties, and will eventually be available at a lower cost.

One of the interesting sidelights that accompanies the announcement is the way in which an imaginative chemist's eyes bug out when he sees the formula for this chemical; he can see that it will react easily and perfectly with many monomers. A new vista for experimentation and development immediately opens before his eyes. Among other things, it will react easily with vinyl chloride, vinylidene chloride, methyl methacrylate, styrene, and alcohols such as glycerol, pentaerithrytol, and ethylene glycol.

Its use with all sorts of chemicals and materials is projected. It may even be used on glass as a colorless coating to make lamps shatterproof. Detergents, dyestuffs, pharmaceuticals, lubricating oils, photo film, and many other products will doubtless be improved in the future; suggested uses for itaconic acid in the plastics industry seem to be almost without limit.

An idea of the broad range possible is perceivable from the patents that have been issued, or are under way, for use of itaconic acid in the plastics industry. Chemists have had the material for laboratory work for many years and have done a great deal of exploratory work but, as mentioned earlier, they have had little encouragement because of scarcity of the acid. The activity among these patent holders is expected to be regenerated when they find itaconic acid so easily available. Here are some of the assertions as to what itaconic acid will do for plastics:

It will improve the toughness, dielectric properties, and lightfastness of polyester cross-linked resins when itaconic is substituted for styrene. When used with polyester plasticizers, it will improve their compatibility and efficiency and possibly reduce the amount of plasticizer required with vinyl chloride resins. Vinyl chloride resin may have improved light and heat stability as well as better flexural and impact strength when itaconic is reacted with the monomer. Itaconic will help diisocyanate set up faster. It will decrease elasticity and increase toughness of nylon and caprolactam.

Still another patent claims that itaconic can be used with fluorene resins to give them more flexural strength. Another claim is that it can be substituted for maleic in alkyd resins to make tough, hard coatings and to accelerate rate of cure. It can be used for development of a plasticizer in cellulose ethers and esters to make them more light stable. In ion exchange resins, it will remove cations from liquid media, according to one patent.

Perhaps one of the first and most sought after uses will be the commercial attempt to incorporate dimethyl itaconate with methyl methacrylate resins to improve surface hardness and give greater resistance to scratching or marring. Successful accomplishment would be a milestone in plastics history. Formulations containing acrylates and itaconic acid have some amazing possibilities since so many things can be done with these two families of highly reactive chemicals.

Another interesting patent is one claiming that a combination of itaconic acid and vinylidene chloride with other materials will produce a coating for cellophane that will give better adhesion than ever before.

And in the synthetic fibre field, it is claimed that itaconic acid will add easier dyeability, reduce static, and increase stability to heat and light. In adhesives, it will help prepare better formulations for lamination, especially for rewettable gummed tape.

Some stuff, eh? No wonder the chemists are excited about it. If it is successful in even a small number of its possible applications, the plastics industry is going to have a material that will offer possibilities for tremendous competition in many fields that have never before been thought of as potential plastics markets.

New Vinyl Chloride Plant

CONSTRUCTION of a new vinyl chloride polymer plant in Hicksville, N. Y., by Insular Chemical Corp. will be completed in early 1956. Insular is owned jointly by Ross & Roberts Co., Stratford, Conn., and Rubber Corp. of America, Hicksville. Both companies are calenderers of vinyl film. Rubber Corp. of America has been appointed exclusive sales agent of Insular for all resin that is produced beyond that needed for the two companies' own operations. Rubber Corp. of America is already a producer of plasticizers and thus becomes a prospective source of the principal raw materials used by vinyl processors. The source of the company's monomer supply has not been revealed.

Spokesmen for the new company emphasize that their new plant is in no sense one of the so-called "package plants" which have been widely talked about in the industry as particularly suited for large individual consumers of vinyl chloride resin. The new plant is the result of a three-year engineering and development program which was thought out and brought to fruition by the joint management of the two concerns involved. Several new resins, probably of the copolymer type, are expected to be produced in the new

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VISIBILITY by Swedlow

IN THE DOUGLAS B-66 SERIES

The Douglas Aircraft Company's B-66 and RB-66 are two of the Air Force's latest and most effective turbo-jet, swept-wing bombers. Their windows of laminated Sierracin plastic present an interesting illustration of Swedlow's ability to solve specific problems in transparent glazing applications. For plastic parts with optical properties of exacting accuracy, the Aircraft Industry has consistently placed full confidence in Swedlow's broad and specialized experience in fabricating transparent plastic glazing materials.

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plant. Insular will thus have vinyl chloride resins for distribution to nearly all segments of the vinyl industry, such as extrusion, wire coating, plastisols, etc., in addition to calendering resin. The latter output will be used in its entirety by Insular's two owners.

This is the first move by the so-called independents in the vinyl industry to set up their own resin plants. There have been many rumors in the past concerning this sort of possibility, but Insular is the first to actually announce a definite program and to indicate that it is prepared to meet a substantial price cut should the major producers ever decide to initiate a drastic price reduction.

Nor are the owners of Insular disturbed about the present vinyl chloride resin capacity which is thought to be more than 200 million lb. in excess of present consumption. Today the vinyl chloride industry is consuming resin at an annual rate greater than 480 million lb., compared with around 400 million lb. in 1954, but most observers think this is a highly inflated volume (see "Vinyl Boom Raises Questions," MODERN PLASTICS *32*, 222, May 1955), based on a temporarily excessive demand by the wire coating and automotive industries. Insular officials feel that they can develop their own customers regardless of the amount of resin on the market.

Didecyl Phthalate Plasticizer

NEWEST addition to Carbide and Carbon Co.'s plasticizer family is Flexol 10-10, a didecyl phthalate, introduction of which awaited full operation of the Texas City, Texas, oxo alcohol plant.

Another Carbide phthalate, Flexol 810, was partially based on oxo decyl alcohol produced in a pilot plant in South Charleston, W. Va. In the future, Flexol 810 will be pushed with greater vigor as more alcohol to produce this plasticizer is made in Texas City.

Carbide claims the following properties for Flexol 10-10: least volatile of commonly used monomeric phthalate plasticizers; excellent electrical properties; extremely low water extractability; very good heat and light stability; low color and freedom from odor; good resistance to "rub-off" from upholstery sheeting; marring action comparable to other phthalates; good low-temperature properties; and plastisols produced from 10-10 have superior viscosity stability characteristics.

Polyurethane Foam

POLYURETHANE foam in continuous blocks and sheets has been in production at the American Collo plant, 525-535 Oritan Ave., Ridgefield, N. J., for several months. Company spokesmen assert that American Collo was the first company to actually produce polyurethane foam in endless lengths in the United States.

The Collo sheet is 30 to 41 in. wide (and will soon be up to 51 in.), with thicknesses varying according to the width of the slab—maximum thickness is eight inches. The company is also providing sheets as thin as 1/16 in. which are sliced from the thick slabs on a specially designed cutting machine.

American Collo also lays claim to having two unusual new developments under way, supervised by its chief chemist, Dr. Joseph Winkler.

The first is a copolymer polyurethane which is not only resistant to acid and alkali, but is also claimed to be structurally stronger than the isocyanate-polyester polyurethane. Collo has also developed a foam that weighs only 1¾ lb./cu. ft. and it is hoped that it will get down to 1½ pounds. It is reported that this foam can be made into panels strong enough for certain kinds of structural work.

There are two kinds of this copolymer. Both are flame-retardant, but one of them contains chlorine to make it even more superior for that purpose. They can be used for thermal and sound insulation for homes, cars, and refrigerators. They can also be made flexible for use as a shock absorber and perhaps as backing for rugs.

The second development is a new catalyst for polyurethane which is described as odorless, thus eliminating whatever odor there is in conventional polyurethanes. Collo asserts that the new catalyst is low in cost and can be used to produce a strong polyurethane at weights from 1.8 to 2.3 lb./cu. foot. It has even been suggested as a suitable packing material for railroad car bearings.

Still another development is a closed-cell pore structure which is reported to be particularly applicable where shock absorption is an important property.

Among the interesting developments now going on for broadening the base of Collo's polyurethane foam applications is the lamination of thin layers to other materials, such as nylon, cotton, or even vinyl film. Such products as inner-soles, blankets, falsies, toilette puffs, terry-cloth (for slippers), and ironing board covers are possibilities. A prototype model of foam laminated to twill for clothing used by the Army in cold weather has been designed. Perhaps of greatest interest to the plastics industry is a thin layer of polyurethane foam laminated to vinyl film for possible use as upholstery or table covers.

Another interesting prototype exhibited by Collo is an overcoat made entirely of polyurethane foam. It doesn't absorb moisture, provides insulation, and is extremely flexible and comfortable. No one has gone overboard on its practicality, but it is offered as a thought-provoker.

Other ideas include polyurethane plugs for drug bottles, outerwear jacket linings, rug cushioning, clothing paddings, and auto upholstery. So far the foam has not been recommended for mattress padding. One of Collo's best items today is polyurethane positioning blocks for X-rays. Its firmness is just right for the purpose; it is hard enough to support the body, yet soft enough to cradle it comfortably, and X-rays are transmitted without distortion or absorption.

Still another Collo development is a foam material that can be molded to form toys and other products. No heat is involved—the polyurethane reacts in the mold by use of an activator. The company is making plans to set up equipment for this work in plants of molders who are interested.

When talking costs, company officials point out that prices have been

coming down gradually. Isocyanate is now $1.20 a lb. in comparison to $2.60 a year ago, and the polyester resin to go with it is 60¢ a pound. Only a small amount of resin is required to produce foam so that it can be produced at approximately the same price as rubber latex foam, according to officials of American Collo Corp.

Polymeric Plasticizer

COMMERCIAL quantities of Harlex 300, a new high-molecular-weight polymeric plasticizer, is now available from Harchem Div., Wallace & Tiernan, Inc., 25 Main St., Belleville, N. J.

Being a true polymeric plasticizer, Harlex 300 has outstanding non-migratory characteristics and low-temperature flexibility when used for plasticizing vinyl resins. It is a moderately mobile liquid, very light in color, and does not possess an odor.

The solvency of Harlex 300 is claimed to be higher than is generally found in polymeric plasticizers. Because of this, it is easily handled in compounding and incorporates readily in calendering or extruding compounds.

This plasticizer is capable of being dry blended and used in plastisols in formulations where, while it is the sole plasticizer, it will still provide easy processing, efficiency, and low-temperature flexibility.

Vinyl Film Fashion Show

VINYL film processors, who are members of The Society of the Plastics Industry, Inc., will hold the first industry-wide vinyl film fashion show and exhibit some time in June. The date had not been set at press time.

The fashion show, to be held in New York City, will present a wide assortment of end-products made of vinyl film which comply with the specifications of the industry Standard of Quality, U. S. Dept. of Commerce Commercial Standard 192-53.

Plastic Film Development, 1955

IMPORTANCE of improved plastics, particularly film, to the packaging industry was emphasized by Charles A. Southwick, consultant and technical editor of *Modern Packaging*, before a recent meeting of the National Flexible Packaging Association. Brief excerpts from his talk (which can be obtained from the association at 850 Euclid Ave., Cleveland, Ohio) are as follows:

"The new Goodyear extruded vinyl film is considerably different from any other vinyl film because it doesn't have the usual high content of plasticizer, has a dry feeling, and is extremely strong. It prints well and is heat-sealable . . .

"The resin from which it is made is also available from Goodyear (Pliovic G-90V) and I see no reason why it could not be applied as a coating on paper. It would be strong, heat-sealable, and greaseproof . . .

"Parapol S resins made by Enjay Co., to be introduced as resins but later to be produced as films and coatings, are unique. They are copolymers of styrene and polyisobutylene. Changing the ratio between these two monomers changes the film from a hard, clear film to a tough, flexible film very much like polyethylene . . . It is also quite soluble in polyethylene and may be interesting for blends . . .

"I have seen some very beautiful thin, strong films made from various nylon resins. They are characterized by high resistance to heat and, therefore, would be difficult to heat-seal and would probably pucker. But they are interesting as strong, thin wrappers or as a base for subsequent coating. There will be several people offering nylon films in 1955 . . .

"Plax Corp. has actually produced a clear, transparent polyethylene film. Don't try to get a transparent film resin from your producer now, but some time in 1955 the matter of cloudiness and lack of transparency in polyethylene will be put to rest forever . . .

"Olin Industries has treated polyethylene film surfaces so that the bag back seam can be sealed with an *aqueous* adhesive and can be run on a conventional bag machine. In 1945 no one thought polyethylene would ever be sealed with aqueous solutions . . .

"There is a tremendous possibility for changing the fundamental properties of polyethylene films by means of surface coatings. They can improve heat-sealing characteristics, greaseproofness, gas impermeability, and flavor retention. A development of tremendous possibilities is the use of polyethylene film as a base for coating, just exactly the way it is done by the cellophane industry . . .

"Users are very enthusiastic about two-way shrinkable polyethylene film. It is considerably lower in cost than other shrinkable materials. It will shrink 30% in two directions by exposure to about 215° F. It has a great future in the meat packing and frozen foods industry."

Leather Fabric's Vinyl Laminate

AMONG the interesting growth features of the vinyl industry is the gradual climb toward upgrading products made from film, sheeting, and coated fabric.

Of the many different routes toward this ideal, one of the most interesting and most promising is the so-called laminating process whereby clear vinyl film is reverse-printed and laminated to a fabric-supported vinyl in such a manner that the printed or decorated side is next to the fabric and is thus "locked in." The top is embossed to avoid a "slick" surface and to give different effects to various patterns. Printing and adhesion problems have been difficult to overcome, but there are now enough products of this type on the market to indicate that the laminating method is successful and the beginning of a trend that will put vinyl in higher price brackets and in high-quality markets.

An example of the quality product available in this type material is the new line recently brought out by Fabric Leather Corp., 16 W. 32nd St., New York, N. Y. Basically, it is fashioned in patterns similar to fabric prints, using three and four colors to effect a linen grain. Unless one has an extra sharp eye, it is almost impossible to distinguish it from fabric. It is a combination of high-style, quality material with all the advantages of vinyl such as washability; grease, dirt, and chemical resistance; and drapability. The material is sold to upholsterers in 52-in. widths at prices ranging from $3.00 to $3.90 a yard. Traditional vinyl-coated material for furniture upholstery ranges all the way from $2.00 to $4.00 a yd., depending upon design and amount purchased.

Fabric Leather executives assert that their pioneering in production of vinyl-fabric laminates was the natural result of conditions peculiar to their plant operations. One is that their manufacturing procedure per-

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mits emphasis on inspection—every piece of goods is carefully inspected after each of the various operations necessary in a laminating process. Such close inspection is necessary because of the trickiness involved in vinyl-fabric laminating. Another reason is that the company has had long experience in the vinyl laminating business. They were one of the pioneers in developing clear elastomeric vinyl laminates with decorative material secured between the laminates. This product has long been used for women's handbags and is today enjoying one of its most popular eras.

Low-Pressure Polyethylene

MOST of the companies now producing or about to produce polyethylene by the usual high-pressure method have announced that they are delving into the new so-called low-pressure field. But the quantity of material so made is still limited to small lots for experimental work.

The industry has been waiting quite some time for an announcement from Phillips Petroleum Co., Bartlesville, Okla., concerning its status in the field. Paul Endacott, president of the company, let it be known more than a year ago that his company was working on a low-pressure polyethylene, to be called Marlex. He has now announced that construction of a plant for this purpose has begun at the firm's Adams Terminal Chemical Manufacturing Works on the Houston Ship Channel, near Pasadena, Texas. A 145 million lb. per year ethylene plant will also be built at the company's refinery near Sweeny, Texas.

The first unit of the Marlex plant will be completed as soon as possible; additional production lines will be added at intervals of several months thereafter.

Marlex will be produced in formulations for molding, film, paper coating, lamination to other films, and wire and cable insulation. Phillips' officials assert that their polyethylene will be stronger, tougher, and in some varieties more rigid than conventional high-pressure material. They also state that it has superior resistance to chemicals and to penetration by moisture, gases, and solvents and that it does not become brittle at temperatures as low as −175° F. Furthermore, it is claimed that Marlex will not soften or deform at the steam sterilization temperature of 250° F. used in pharmaceutical practices and in hospitals. Conventional polyethylene softens at temperatures below the boiling point of water.

Company officials stated that their process will be licensed to others in the near future. They have said nothing about price as yet. Technicians in the industry assert that there is reason to believe that the low-pressure method is essentially a lower-cost operation than the complex and somewhat hazardous high-pressure method, which requires equipment capable of withstanding over 30,000 p.s.i. However, these same technicians also assert that low-pressure polyethylene is a somewhat different type of material than high-pressure polyethylene and only time will tell how close it comes to duplicating polyethylene as presently known.

Improved Coated Fabric

QUALITY of vinyl-coated fabrics has improved considerably in the past two years, largely through development of more suitable backing materials. The latest step combines the better properties of uncoated vinyl sheet and coated vinyl sheet and eliminates most of the troublesome properties that are present when either is used alone.

The new material, Nygen Tolex, has been developed by Textileather Div., The General Tire & Rubber Co., Toledo 3, Ohio. The company has not released details on construction of the backing material except to report that it is of a nonwoven construction that eliminates any tendency to "clothiness" in the finished effect. When coated with vinyl it is so tough that a cut started with a knife or scissors is almost impossible to continue by pulling with the hands. Upholsterers should have no trouble with ripping or tearing when they apply this material. On the other hand, the backing is so pliable that the vinyl surface can be embossed with effects that are equal to those obtained on unsupported vinyl sheeting. Edge tear, stitch tear, tensile strength, and resistance to flex and fold have been given exceptionally high ratings in independent laboratory tests. The base material provides bulk and a most desirable hand to the finished product which has many of the characteristics of leather with few of the faults. It seems ideal for deep-seat cushion upholstery of almost any variety, including automotive.

Mylar Price Reduction

COST of Du Pont's Mylar polyester film has been reduced 35¢ a lb. on all types and gages, except 25 gage, the thinnest film. The basic price range now varies from $2.50 a lb. for 750 gage to $4.00 a lb. for 25 gage. The Class A type, generally considered most useful for insulation and dielectric use, in 50-gage or ½-mil thickness, is now $3.00 a pound. The yield is 40,000 sq. in./pound. The 750-gage Class A material is now $2.50 a lb. with a yield of 2650 sq. in./pound. These prices are based on rolls of film 1½ in. wide and over. Minimum order is 5 pounds.

Class C Mylar, which Du Pont lists as a material fitted for good high-temperature insulation and for all packaging applications, is the same price as above for 50 gage or ½ mil but is only listed in thicknesses up to 100 gage or 1 mil. The 1-mil material is priced at $2.50 a lb. with a yield of 20,000 sq. in./pound.

Class D is a highly transparent film available in gages of only 300, 500, and 750 at $3.00 a lb., with yields of 6650, 4000, and 2650 sq. in./pound.

This price reduction is the second since the new plant in Circleville, Ohio, came into production last fall.

Vinyl-Nylon Tarpaulins

PRODUCTION of tarpaulins and coverings of all shapes and sizes, plus a complete line of tents, has been announced by Fellowcraft Engineering, Inc., 270 Jelliff Ave., Newark 8, N. J.

Designated as the Herculite line, the products are made from a new lightweight material which incorporates both nylon and vinyl film. Among the features claimed for the

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Herculite line are exceptional tear strength, waterproofness, colorfastness, resistance to corrosion and mildew, and easy storage. The material has met most rigid specifications of the armed services. All seams are electronically welded.

President of the company, Marvin M. Tallerman, states that with the use of this special electronic equipment, Fellowcraft has made a completely electronically sealed tarpaulin 160 by 85 ft., which has been purchased by a National League baseball park. The material formerly used at the ball park weighed approximately 3000 lb. and required 11 men to handle it; the Herculite tarpaulin weighs 1150 lb. and only five men are needed to handle it.

Cross-Linked Thermosets

CONSIDERABLE interest has been aroused in the United States concerning a plastic material being produced by Peterlite Products, Ltd., 24-28 Lombard St., London E.C.3, England. An inquiry brought the following answer:

"Peterlite plastics are a new type of material. They are copolymers which are clear and transparent. In finished form they are thermoset and strongly heat resistant. Organic and inorganic chemicals do not attack the products to a serious degree. There are varied types in which one or the other physical property may be enhanced.

"The essential difference between our products and normal plastics is that by a patented process there is produced a solid material in (say) sheet form which is 'half cured' and flexible. At a moderate temperature of 100° C., the material becomes soft enough to shape and mold with low pressure. Reinforcing material can be incorporated without destroying this workability. After shaping or molding, the material is subjected to a temperature of 130 to 150° C., which produces a cross-linked thermoset."

Various bits of information have been printed about this material in the United States from time to time during the past six months. The gist has been that this product is supposed to be clear, colorless, will withstand unusually high heat, can be alloyed like metal, won't craze, scratch, *nor suffer from fatigue*. An informed British source believes the material is intended primarily for transparent aircraft canopies. Cautious observers are waiting to see the material and evaluate its performance in use before passing any comment on its future possibilities.

Die Casting Engineers

A NEW technical society, the Society of Die Casting Engineers, Inc., has been formed to foster and further technological advances in the field of die casting and finishing of metals and die molding of plastics and powdered metals.

The first Chapter to be formed within the new organization is the Detroit No. 1 Chapter. President of the group for the calendar year 1955 is Harris R. Shimel, Chevrolet Bay City Div., General Motors Corp.

The new society's national headquarters and offices will be located at 19370 James Couzens Highway, Detroit 35, Mich.

S.P.E. 1956 Meeting

TWELFTH annual conference of the Society of Plastics Engineers will be held January 18 to January 20, 1956, at the Hotel Statler, Cleveland, Ohio.

Details of the meeting are being arranged by the executive committee and special committee chairmen. Frank A. Martin, The Hoover Co., is general chairman of the executive committee and Sherman W. Crawford, Detroit Molded Engineering Co., is co-chairman.

Dispersed Pigments

DEVELOPMENT of a new line of ultra-fine color pigment dispersions in paste form, known as the 0100 series, has been announced by Acheson Dispersed Pigments Co., 2250 E. Ontario St., Philadelphia 34, Pa.

The company states that because of the extreme fineness of dispersion, the use of these pastes will result in a considerable saving of equipment time, as well as the elimination of a large part of off-color scrap. Once the compound formula is set up to give the correct color on the calender or extruder, ADP color control will assure that subsequent batches, if made the same way, will produce the identical color. This will be true whether the next batch is made the same day or months later. Also, since the pastes are stabilized against agglomeration, streaks and tails should be eliminated.

In order for the user to prove to himself how accurate the company's control system is, it is recommended that he hold out a sample from the first shipment of each color paste, to check against future batches.

The regular standard line of ADP paste dispersions will still be available at a slightly lower price than the new ultra-fine 0100 series of pastes, according to the company.

Fire-Retardant Plasticizer

SEMI-COMMERCIAL production of a new fire-retardant plasticizer, Celluflex CEF (tris B-chlorethyl phosphate), has been announced by Celanese Corp. of America's Chemical Div., 180 Madison Ave., New York 16, N. Y.

Celluflex CEF gives fire-retardant properties to a variety of molded and extruded plastics and surface coatings, including vinyls, cellulose acetate, ethyl cellulose, cellulose nitrate, butadiene-acrylonitrile copolymers, and rubber chloride, where its clear water-white color permits its use in transparent and pastel shaded items.

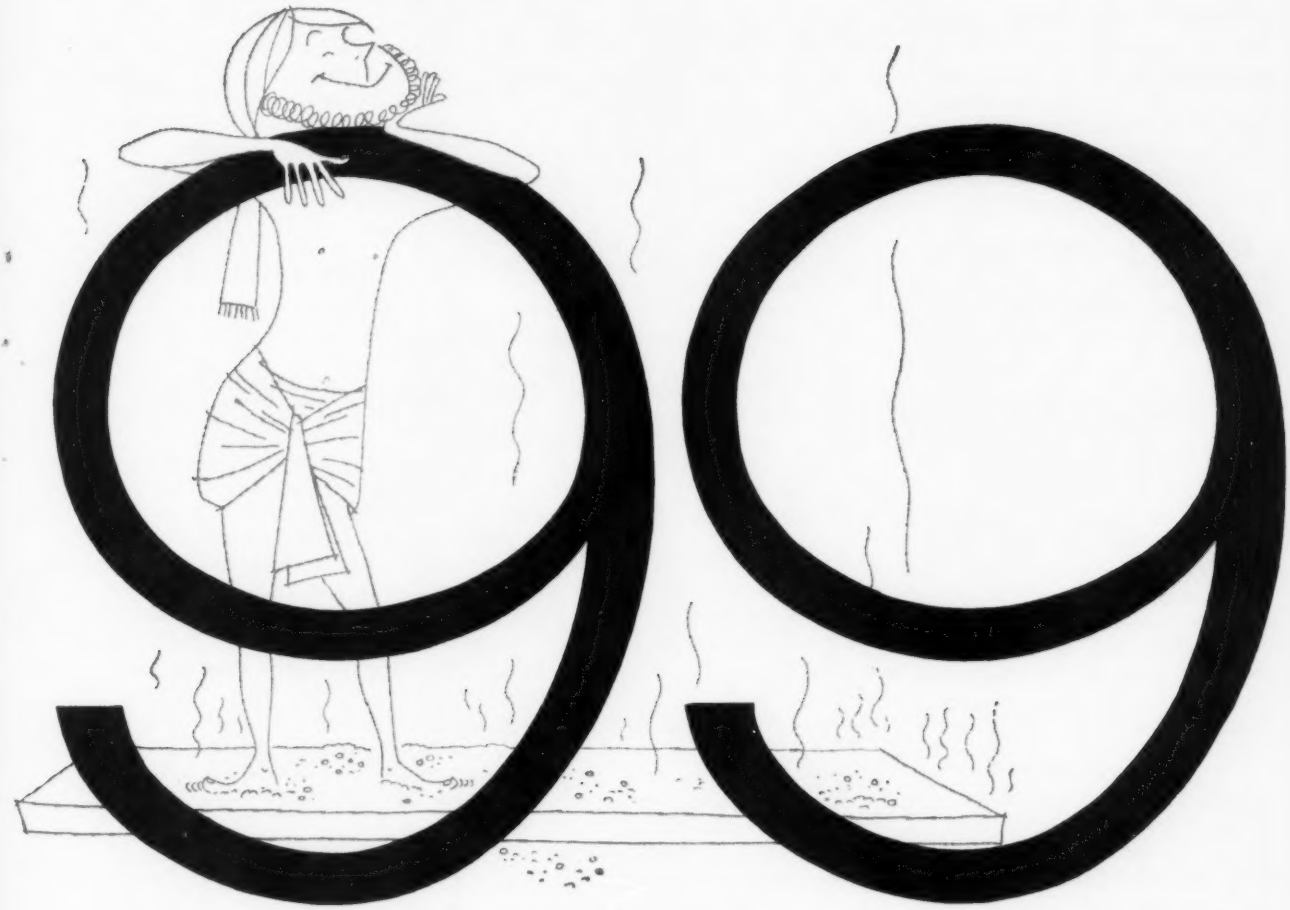
General manager of the Chemical Div., Richard W. KixMiller, states that the new plasticizer is significantly more chemically stable than competitive materials, as is indicated by the fact that the acidity of the product, even after being subjected to elevated temperatures, is considerably lower than other trichlorethyl phosphates.

Acrylic Sheet Supplier

FULL production of CO4 acrylic, optically clear cast rigid sheets, is now under way in the plant of Cast Optics Corp., 123 Newman St., Hackensack, N. J. The product is an addition to the firm's line of specialized, optically clear rigid acrylic sheet materials.

CO4 is available in thicknesses ranging from 0.020 to 1 in. and in

LUSTREX* HI-HEAT 99



New heat-resistant styrene withstands temperatures of 198-204°F.

Beats the heat! Monsanto has now broadened its line of styrene molding compounds to include a new heat-resistant material.

In addition to thermal stability at temperatures between 198-204° F., Lustrex Hi-Heat 99 retains the same excellent electrical, mechanical and chemical properties of Monsanto's general purpose styrene. It is ideal for radio cabinets, battery cases and other applications requiring greater resistance to heat distortion than is possible with any general purpose compound.

The material is available in three forms: Granular Crystal Colorant Blend – Pelleted Lubricated Crystals – and Pelleted Lubricated Colors.

Lustrex Hi-Heat 99 can be molded on standard injection machines in molds designed for general purpose styrene. On certain jobs shorter cycles are often gained because of the fast-setting properties of this new material.

It can be cemented readily with a good bond, and can be lacquered to give beautiful decorative effects with the same formulations applied to general purpose styrene. The same machining procedures used for general purpose thermoplastics can be adapted to Lustrex Hi-Heat 99.

For technical bulletin *on using Lustrex Hi-Heat 99 in both injection and extrusion equipment, write Monsanto Chemical Company, Plastics Division, Dept. MP6, Springfield 2, Mass.*

MONSANTO

*LUSTREX REG. U. S. PAT. OFF.

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sheet sizes for such uses as windows, displays, signs, pocketbooks, instruments, and marine and other equipment. Used as a base for lamps or with furniture, the sheet can be polished to a beautiful finish for ornamental purposes. All sheets are completely masked when shipped.

Diamond's Electrical-Grade Vinyl

ACCORDING to an announcement by Diamond Alkali Co.'s Plastics Div., 300 Union Commerce Bldg., Cleveland 14, Ohio, Underwriters' Laboratories, Inc. has found Diamond P.V.C.-50 acceptable as an interchangeable basic resin for use in all UL-listed vinyl electrical compounds.

Newly developed insulating compounds for T and TW building wire and 80° C. appliance wire have also been accepted by Underwriters' Laboratories.

Processors and fabricators may secure formulas and other data covering these electrical compounds from the company.

Ethyl Cellulose Sheet

COMMERCIAL availability of ethyl cellulose sheet and film has been announced by Campco Div., Chicago Molded Products Corp., 2717 N. Normandy Ave., Chicago 35, Ill.

Company officials say that the line has been added to their other thermoplastic sheet materials because of insistent demand for a more stable, transparent sheet for use in such fields as displays, packaging, and similar items.

Mylar-Insulated Telephone

PRODUCTION rate of telephone switchboard wire has increased 35 to 46% since a large Eastern manufacturer adopted Mylar as a primary insulating material, according to an announcement by Du Pont.

The manufacturer states that the switch to Mylar was made to meet increasingly heavy demands for telephone switchboard wire which could not be produced with present plant equipment in sufficient quantities to keep up with orders.

The film, in tape form, is only half the thickness of the old insulation but has more than twice its tensile strength. The new wire—tinned copper—consists of Mylar, cotton, yarn, and an outer coating of flame-resistant lacquer.

Some of the advantages of Mylar for this particular job are: The material can be made in gages as thin as ¼ mil, providing space savings by eliminating bulkier insulating materials; it has improved electrical characteristics in humid climates; Mylar is so tough that it is not damaged when wires are bent or drawn over sharp corners; outside diameter of finished wire is reduced by approximately 5 mils; and it has a primary insulating melting point (482 to 492° F.) which can be soldered through without stripping.

Polyethylene-Coated Paper

ANOTHER company has been added to the rapidly growing list of polyethylene-coated paper producers. Latest is Guardian Paper Co., Oakland, Calif. The company will produce 72-in. polyethylene-coated sheet at a top speed of 400 ft./minute.

The equipment, installed by Dilts Machine Works, Fulton, N.Y., includes a Hartig 4½-in. extruder, a Dilts Model PL-400 polyethylene extruder-laminator, and a Dilts Surfastart winder.

Phenolic Foam

TRADENAMED Corfoam 114, a new liquid, lightweight phenolic resin used for structural core applications which provides 50% more strength than previous Corfoam, has been announced by Rezolin, Inc., 5736 W. 96th St., Los Angeles, Calif. The material offers a compressive strength of 37 p.s.i. for a 3-lb. density and ranges to 1100 p.s.i. for the 21-lb. density.

Corfoam 114 will foam to a hard consistency at ambient temperature; density is controlled by the amount of foaming agent used.

The material is used as a core for stretch dies, jig dies, check fixtures, and models. It may also be used as an insulating or soundproofing material; buoyancy cores reinforced with fibrous glass laminates for small boat and marine applications; filler blocks for aircraft pressurizing tests; and contour packing of delicate items.

Corfoam 114 can be formed in large masses without heat or pressure to produce a hard honeycomb-type cellular material. It may be foamed in place or removed from the mold when hard and readily fabricated into desired shapes with ordinary woodworking equipment. The material is easily mixed by hand or with simple mechanical mixing equipment.

Odor-Free Plasticizer

COMMERCIAL availability of Citroflex A-4, an improved, low-cost, odor-free citric acid ester plasticizer, has been announced by Chas. Pfizer & Co., Inc., 630 Flushing Ave., Brooklyn 6, N. Y.

Known chemically as acetyl tributyl citrate, Citroflex A-4 is reported to have been accepted by the Food and Drug Administration for use in films for food and beverage containers, and as a component of plastic meat wraps by the Bureau of Animal Industry, U.S.D.A., and the Office of the Quartermaster General.

The company also announces that Citroflex A-8 (acetyl tri-2-ethylhexyl citrate), has been added to its family of citrate plasticizers.

Vinyl Coating Equipment

EXPANDED facilities of its converting laboratory at Fulton, N. Y., to accommodate a wider range of coating applications and customer problems has been announced by the Dilts Machine Works, Div. of Black-Clawson Co. Customers interested in coatings can use these facilities for investigating coating applications using melts of from 5- to 30,000-cp. viscosity at temperatures up to 400° F.

Sherwin-Williams' Polyesters

ANNOUNCEMENT has been made by The Sherwin-Williams Co., Cleveland 1, Ohio, producer of paints, that the company has entered the polyester field and will bring out a full line of resins used in the manufacture of reinforced plastics. Dr. J. A. Arvin will supervise research and C. R. Martens will head development and sales service. Dr. Arvin states that the firm's decision to develop and market polyester res-

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ins reflects the ever-narrowing gap between the paint and plastics industries.

Sherwin-Williams will concentrate on a "custom service" approach to plastics manufacturers. Although standard lines of polyester resins will be offered under the tradename Poly-Kem to meet general requirements, the company plans to augment these with specialized formulations designed for specific applications.

Thickening Agent

DESIGNED for use with many commonly used synthetic latices, a new thickening agent called Acrysol G-110 is now available from Rohm & Haas Co., Washington Sq., Philadelphia 5, Pa.

When used in concentrations of 1% or less, Acrysol G-110 is claimed to be from three to 20 times more effective—as measured by the viscosity of the final latex composition—than currently available thickeners. The new thickening agent, an ammonium polyacrylate solution, is suggested for use with commercial latex formulations of the butadiene-styrene, unplasticized styrene, vinyl chloride, and vinyl acetate type. The degree of thickening for a given concentration depends upon the specific polymer used.

Suggested applications for Acrysol G-110 are in the manufacture of dipped, cast, or molded goods; adhesives; cements such as those used for combining rug backing and pile fabrics; and in spraying, brushing, and extruding compounds.

Phenolic-Glass Molding Materials

A NEW series of glass-reinforced phenolic molding materials has been added to the regular line of molding compounds produced by Rogers Corp., Rogers, Conn. Designated as RM 4015 and RM 4030, these materials are designed for heavy-duty industrial applications and offer high tensile and flexural strength, a bulk factor of two to one, fast rate of cure, excellent moldability, and long shelf life.

Available as sheets and blanked preforms, RM 4015 and RM 4030 lend themselves to standard molding operations, high-speed tapping, and use of molded-in inserts. The products, clean and dust-free, permit use of very shallow molds and also lend themselves to use in molds designed for low-bulk general-purpose materials.

Effect of Geography on Plastics

OVER the years the geographical map of the plastics processing industry has embraced only three or four areas of high concentration with sparsely scattered plants in other parts of the nation. The bare spots on the map are beginning to become populated with more plastics plants. Although the growth is slow, it is a testimony to the ever expanding usefulness of the plastics industry and an indication that the industry is not only producing more of its basic items but also broadening its base with new products of more use to more people.

The older and more concentrated geographical areas are, broadly speaking, the northeast from Boston to Philadelphia; Ohio and Michigan; Illinois; and California. Among the less populated areas where plastics growth is beginning to take hold in substantial measure is the southeast where new plants are moving in, and those started in the late 1940's are expanding to become a potent influence in Dixieland's industrial growth.

Attention has been called to the latter factor by Electro Plastic Fabrics, Inc., at Pulaski in southwest Virginia, which states that the company floor space has grown from 5000 sq. ft. five years ago to a present area of 50,000 sq. feet. Annual sales have increased from $30,000 to $2,750,000. Number of employees has gone up from 25 to 350 and the investment in machinery and equipment has risen from an initial $17,000 to $285,000.

Favorable location factors, according to Dick Beaver, president of the company, are four: electric power; an excellent reservoir of manpower; the expansion of other industrial enterprises in the South which helps to create new markets; and the need for specialty products (such as covers for tobacco bed fumigation).

Electro Plastic Fabrics is the creator and major producer of the vinyl chloride windshield washer bag which is now common equipment for most autos. Another product is a "1000-bushel bag" for grain storage. Prominent also are huge vinyl-coated tarpaulins for use at Armed Service arsenals. Other vinyl-coated nylon tarpaulins are produced for boat and car covers, trucks, machinery, building materials, and grain.

By combining vinyl with old standbys such as cotton, nylon, or glass, Mr. Beaver says he has built a new business out of improving older products by combining their various properties with vinyls, and in an area that abounds in weaving and knitting mills so that he may get a large share of his raw material almost as easy as walking out the back door.

French Silicones

COMMERCIAL production of a complete line of silicones has been started by Société Rhone-Poulenc in its new $3 million plant, Les Carriers, located in St. Fons, near Lyon, France.

The company claims to be the first in France, and possibly in Western Europe, to undertake production of silicones to meet the growing European demand. Research on silicones was initiated by Société Rhone-Poulenc in 1942.

Price Reduction for Isocyanate

PRICE cuts of as much as 50¢ a lb. for isocyanate compounds have been announced by Mobay Chemical Co., St. Louis 4, Mo.

Mondur TD, a mixed isomer tolylene diisocyanate used in the manufacture of flexible and other types of polyurethane foams, has been reduced from $1.40 to $1.20 a lb. in 55-gal. lots. Mondur TDS, a 2,4 isomer tolylene diisocyanate for use in the manufacture of rigid polyurethane foams, has been reduced from $2 to $1.50 a lb. in 55-gal. lots. Similar price reductions were made for both products in smaller lots.

Mobay's general manager of sales, J. D. Mahoney, states that continued progress in the New Martinsville, W. Va., plant, scheduled to begin operation in October, and delivery of several German-made, continuous

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KEL-F Plastic Molded and Fabricated Valve Linings, Valve Diaphragms, Gaskets, Ring Seals, Gauge Crystals, KEL-F Dispersion Coated or Laminated Lined Tanks, Vessels, Reactors, Piping and Tubing can protect your plant equipment against chemical corrosion

KEL-F Fluorocarbon Plastic is the best non-permeable, corrosion-proof material available today. It is inert to virtually any type of chemical attack—including mineral acids, oxidizing agents as well as strong caustics. When nothing else will protect equipment, KEL-F Plastic usually will.

HERE ARE SOME OF ITS OUTSTANDING CHARACTERISTICS:

Temperature Tolerance

Exhibits satisfactory properties over a temperature range of approximately 710° F. (—320° F. to 390° F.)

High Compressive Strength

Pressures of 8,000 psi result in only 4% to 5% permanent set. Line seals are retained longer when gaskets and O-ring seals are made of KEL-F Plastics.

Non-Adhesive

KEL-F Plastic is non-wetting even after long periods of immersion. Surface is anti-fouling when in contact with even the most viscous liquids.

KEL-F Plastic is a thermoplastic and easy to fabricate. It is readily molded by extrusion, transfer and injection. Available in sheets, rods, tubing and film, it can be fabricated, heat formed, machined and heat-sealed by a growing list of experienced fabricators.

New! KEL-F Plastic Dispersions

KEL-F Plastic Dispersions have been developed for bake-coating of metallic surfaces that must be corrosion resistant, anti-adhesive and electrically non-conductive. These Dispersions can be applied by spraying, spreading or dipping.

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polyurethane production machines to Mobay licensees in the United States made the price reduction possible.

The company recently announced a 10% reduction in the price of the special polyester materials used in making the polyurethane foams.

Epoxy Adhesive

NOW available from Ed Conley Plastic Corp., 321 S. Quincy St., Tulsa, Okla., is a new industrial adhesive, using epoxy resin, which can be activated by mixing equal parts, thus elminating waste, weighing, and danger from toxic catalysts.

Designated as Conley-Weld C1-C-2, the material is said to cure at room temperature or can be production-line cured quickly in a low-temperature oven to provide a bond which approaches 2500 p.s.i. tensile shear with most plastics, steel, aluminum, brass, glass, wood, ceramics, and masonry.

The company states that the adhesive has been found successful for tank and pipe line repair in the oil and gas fields.

Teflon Rod

PRODUCTION of extruded electrical-grade Teflon rod has been announced by Tri-Point Mfg. & Developing Co., Inc., 401 Grand St., Brooklyn, N. Y. The product is available in diameters from ¼ to 2 inches. Quality certification by an independent testing laboratory can be furnished for each shipment of rod.

Acetate Typewriter Ribbon

ALL-PURPOSE acetate film typewriter ribbon for use on all machines with carbon ribbon attachments and suitable for general correspondence, as well as for photo-offset reproduction, has been developed by Rochester Ribbon & Carbon Co., Inc., 20 Greenleaf St., Rochester 3, N. Y.

Tradenamed Polycar, the ribbon is claimed to produce a sharper impression than carbon paper ribbons and to be practically smudgeproof.

The company states that Polycar's great strength is its most outstanding feature. It is almost unbreakable, which eliminates one of the basic disadvantages of carbon paper ribbons, and has won acceptance wherever tested.

The acetate film base used in the new ribbon is so much thinner than the paper base used in carbon paper ribbons that over a third more Polycar can be spooled on the same size reel, thus reducing the time required for changing ribbons.

Double-Faced Tape

PRESSURE-SENSITIVE tape for Class H insulation with adhesive coating on both sides has been developed by Mystik Adhesive Products, 2635 N. Kildare Ave., Chicago 39, Ill.

The tape, called Mystik Brand No. 7100, has a fibrous glass backing and a newly developed silicone adhesive. The firm reports that extensive temperature tests show that the new product bonds tightly at temperatures ranging from −100 to 550° F.

Finish for Reinforced Plastics

A STATEMENT based on surveys made in the field was recently issued by J. Stanley Bowen, research director of Lunn Laminates, Inc., Huntington Station, N. Y., as follows: "Vending machines, luggage cases, office machinery housings, baby carriages, boats, and automotive parts, inside or outside the car, are among the many new applications presenting a market for Lunn Finish #107."

The new process, claimed to be the only one of its kind developed in the industry, completely conceals the fibrous glass mat patterns. It also eliminates buffing, sanding, and painting of parts manufactured by matched metal molding or by bag molding, thereby speeding production and cutting costs in time and labor, according to Mr. Bowen.

Do-It-Yourself

HIGH-PRESSURE melamine laminates, including the decorative type, are now being made in 1/10-in. thickness for the professional trade by St. Regis Paper Co.'s Panelyte Div., 230 Park Ave., New York 17, N. Y. It was originally brought out for the do-it-yourself market, but the pro's became interested and found that they could save installation time by using the 1/10-in. material.

On the other hand, the "do-it-yourselfers" have begun using more of the 1/16-in. product. As a result, St. Regis now markets both thicknesses for both fields with equally good results.

Chemical-Resistant Plastisol

A NEW chemical-resistant plastisol has been developed by Watson-Standard Co., 218 Galveston Ave., Pittsburgh 12, Pa. Called 16-093, the compound is supplied as a free-flowing liquid and is converted by heat into a flexible rubber-like coating for application to metal parts. Thickness of the coating may vary from 1/32 to ½ in. and it is said to be a smooth, dense, tough, abrasion resistant, and resilient film.

The plastisol is primarily formulated for dipping application, using either the cold- or the hot-dip technique. However, it may be modified for spraying or roller-coating methods. The compound is claimed to be ideal for racks, tote baskets, tank linings, valve parts, shelving, and other metallic surfaces where chemical resistance is a prime requisite.

More Polyester

NEW entrant in the polyester field is Plumb Chemical Corp., 4837 James St., Philadelphia, Pa., an affiliate of Fayette R. Plumb, Inc.

The new firm will manufacture fibrous glass-reinforced Fibercore molding compounds formulated to provide exceptional strength and excellent flow properties. These compounds, with precatalyzed resins and controlled glass-resin ratios, are available in three grades: chemical, electrical, and flame-resistant.

President of the new company is James L. Harvey.

Laminated Mylar

DEVELOPMENT of Doray, a metallized Mylar polyester film laminated to flexible backing materials, has been announced by Dorrie Process Co., 60 Greenpoint Ave., Brooklyn, N. Y.

The laminate combines the outstanding physical properties of the

polyester film—abrasion resistance, resistance to attack by moisture and solvents, flexibility, durability, and high tensile strength—with the appearance of a metallic sheen.

Doray has already been accepted by the automotive industry for such uses as interior trim on door panels, welting, and kickpads. It is also finding many new applications in women's fashion accessories. The material can be heat sealed, vacuum formed, cemented, and embossed in a wide variety of designs.

The film is metallized by an exclusive process developed by Dorrie which ensures a metallic finish resistant to tarnishing, clipping, or flaking and is available in chrome, gold, copper, many pastel tints, and multi-color effects.

EXPANSION

Bakelite Co., a Div. of Union Carbide and Carbon Corp., has established a laboratory at Bound Brook, N. J., exclusively for scientific investigation of plastics packaging problems. A staff of 30 scientists, engineers, and technicians with the most modern types of packaging equipment has been assembled for this purpose. The laboratory will concentrate on practical packaging problems involving the use of Krene and Bakelite plastics and resins, as well as conduct other explorations.

The Marblette Corp., 37-21 30th St., Long Island City 1, N. Y., has launched a half-million-dollar expansion program to facilitate research and increase production. The addition of 15,000 sq. ft. of floor space to Marblette's present plant is expected to be completed by July. It will house research laboratories and general and administrative offices. The new facilities will free a correspondingly large plant area as added room for manufacturing Marblette epoxy and phenolic resins.

Synthane Corp. has started construction of a new wing on its plant in Oaks, Pa. The 50- by 160-ft. structure will add 8000 sq. ft. to the existing plant area of 167,000 sq. feet. It will house the automatic screw machine department and provide increased facilities for lacquering, moistureproofing, and fungicidal treatment of various grades of sheet stock, rods, tubes, as well as provide space for the production of copper-clad laminates, the basic material used in the manufacture of printed circuits. This is the company's eighteenth major plant expansion since its factory, first built in 1929.

Foster Grant Co., Inc., Leominster, Mass., manufacturer of plastics moldings which started production of styrene monomer for the first time a year ago, announces that it will expand production of its Baton Rouge, La., monomer plant to more than double its present capacity.

President of the company, **Joseph C. Foster,** states that the expansion program will provide a capacity of more than 50 million lb. of styrene annually—the plant was originally constructed to produce 24 million lb. annually. Completed about a year ago, the Baton Rouge plant employs chemical manufacturing processes first developed in Germany and said to be unique in this country. Application of the new techniques made it possible for Foster Grant to construct the plant at a cost of far less than had been thought feasible prior to that time.

Raffi & Swanson announces the opening of a million-dollar plant in Wilmington, Mass., for the manufacture of industrial finishes. The plant is now supplying spray lacquers for styrene and acetate moldings and sheet stock; gravure inks for vinyl sheeting; basecoats and topcoats for vacuum metallizing; and cements for assembling styrene, acetate, or nitrate products.

Olympic Plastics Co., Inc., 215 E. Washington Blvd., Los Angeles, Calif., has constructed a factory building on a 2-acre site located at 5471 W. Jefferson Blvd., Los Angeles. This marks the third expansion for the company; in 1948 an addition was built to the present main plant and in 1950 a second plant was leased to house the firm's fibrous glass affiliate, Olympic Reinforced Plastics Corp.

Glass Laminators, Inc., 524½ First Ave. So., Seattle 4, Wash., announces a three-fold expansion of its floor space. The company has redesigned its production processes to operate on a continuous basis. Principal items manufactured by Glass Laminators are corrugated translucent fibrous glass panels. The firm also produces fibrous glass panels which are decorated with leaves, flowers, butterflies, etc. A custom service is offered to purchasers whereby they may bring in their own leaves and flowers to be cast in plastic.

Chemical Products Corp., East Providence, R. I., has broken ground for the construction of a $500,000 building. Included in the expansion program are enlarged facilities for the manufacture of the company's plastisol formulation, Chem-O-Sol, and laboratory and research departments to continue the development of new uses for the material.

COMPANY NOTES

The Borden Co.'s Chemical Div., 350 Madison Ave., New York 17, N. Y., announces that **Dr. B. David Halpern** has been appointed research director of its research laboratory in Philadelphia, Pa. Dr. Halpern was formerly president of Monomer-Polymer, Inc., Leominster, Mass., recently acquired by Borden. **D. F. Gould,** formerly manager of the Philadelphia laboratory, has been transferred to the company's New York office as assistant to **W. R. Moffitt,** vice president and technical director of the Chemical Div. In addition to the manufacture of specialized monomers, polymers, and reagent chemicals, Monomer-Polymer performed considerable research on government contracts. The organization functioned as the research and development laboratory of American Monomer Corp., developing improved processes for the production of polyvinyl alcohol, polyacrylate dental powders, acrylon rubber, and other solid polymer products. All of these are either in successful commercial production or well through the pilot-plant stage.

The Dow Chemical Co., Midland, Mich., announces the following changes in and additions to the duties of nine of its employees, in line with plans for extending and improving plastics development and customer service: **William E. Brown** will assume additional responsibilities in the Plastics Technical Service testing section; **R. C. Cottrell** will expand his activities in Dow textile materials; **Joseph Eveland** will broaden his work on injection and compression molding materials; **F. Jack Gibbs** will assume added duties in equipment development for the use of saran film; **Maurice**

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Q. Tessin has increased responsibilities as staff coordinator of field development and technical service on polyethylene; **Harold J. Waite** will give customer assistance in the use of Styrofoam; **Ted C. Broadwell** and **Casimer A. Burczyk** have been assigned additional duties in connection with the extrusion of Dow plastics; and **James L. Forse** will work on corrosion-resistant sheet and plastics sheet for vacuum forming.

Koppers Co., Inc., Pittsburgh 19, Pa., announces the formation of a Marketing Dept. under the direction of **Ralph Winslow,** vice president of the company. The new department will include sales management, market and economic research, sales personnel development, sales promotion, and advertising and public relations sections.

The company also announces that **George W. Naylor,** recently appointed manager of its Chemical Div.'s International Dept., has been named a vice president of the division. **Cooke Bausman, Jr.,** recently named assistant to the general manager of the Chemical Div., has been made assistant vice president of the division.

St. Regis Paper Co., 230 Park Ave., New York 17, N. Y., has acquired 100% of the capital stock of Michigan Molded Plastics, Inc., Dexter, Mich., which will be known as **Michigan Panelyte Molded Plastics, Inc.** The Michigan company, with its facilities for custom injection and compression molding, augments the production of the equipment at other Panelyte plants in Cambridge, Ohio; Richmond, Ind.; and Trenton, N. J.

The new subsidiary, which employs about 200 people, will continue to operate under the same management.

Nopco Chemical Co., Harrison, N. J., announces that **Ralph Wechsler,** formerly treasurer, has been elected president of the company. He succeeds **Thomas A. Printon,** who will continue to serve as chairman of the board. Mr. Wechsler will also act as chief officer of **Metasap Chemical Co.,** a wholly owned subsidiary of Nopco. **Benjamin S. Collins** has been appointed chief development manager of the Plastics Div. He will be in charge of the development program for Lockfoam, foamed-in-place plastic.

National Vulcanized Fibre Co., Wilmington, Del., has named **Gerard A. Albert** as manager of manufacturing and **Henry C. Guhl** as manager of engineering. Mr. Albert, formerly staff manager, has been with the company since 1929. Mr. Guhl, previously manager of process engineering, was formerly associated with Westinghouse Electric Co. as manager of engineering of the Micarta Div.

New England Laminates Co., Inc., 16 Dyke Lane, Stamford, Conn., has been recently formed and will manufacture plastics laminates for the electrical and electronics industries and metal-clad laminates for printed circuitry. **John E. Currier** is president of the new company.

Worcester Moulded Plastics Co., Worcester, Mass., has opened a branch office at 520 Granite Bldg., Rochester, N. Y. **George E. Mayo** has been appointed manager of the new office.

Ciba Co., Inc., 627 Greenwich St., New York, N. Y., has made an arrangement with **General Mills, Inc.,** Minneapolis, Minn., to market polyamid resins in the United States. Ciba will also furnish complete technical service to General Mills' customers, as it does for buyers of its own line of Araldite epoxy resins.

Molded Products, Div. of Admiral Corp., formerly known as Molded Products Div., Admiral Distributors, Inc., has moved into its new plant located on Washington St. and Creamery Rd., West Chicago, Ill.

Hooker Electrochemical Co., Niagara Falls, N. Y., announces that under the terms of the proposed consolidation of Hooker and **Durez Plastics & Chemicals, Inc.,** Hooker will be the continuing company and the business of Durez will be operated as the **Durez Plastics Div. of Hooker.**

New officers of Hooker were named as follows: **Harry M. Dent** and **John F. Snyder,** respective president and senior vice president of Durez, have become directors of Hooker. Mr. Snyder has also been made a vice president. **Alfred W. Hanmer, Jr.** and **Dr. Walter H. Prahl,** vice presidents of Durez, have been appointed vice presidents of the Durez Plastics Div. and **Edward W. Mathias,** treasurer of Durez, is now treasurer of the new division.

Archer-Daniels-Midland Co., 700 Investors Bldg., Minneapolis 2, Minn., has established a new products development department. **Dr. George K. Nelson,** formerly affiliated with Celanese Corp. of America and Shell Development Co., has been named director of the department. He will evaluate the market potential for new products developed in ADM research laboratories, will be responsible for their introduction, and will supervise the company's market research activities.

Liquid Casting Systems Co., 125 65th St., West New York, N. J., has entered the plastics field as an epoxy casting service for potting, embedment, or encapsulation of capacitors, coils, and various other electronic components. The firm will also supply epoxy resins compounds.

Liquid Casting also offers proportioning-mixing and mold filling equipment claimed to be accurate, inexpensive, easily maintained, and adaptable to automation in the customer's plant.

Cosmos Electronic Machine Corp., 656 Broadway, New York 17, N. Y., has been recently formed to manufacture heat sealing equipment. The company has exclusive rights to a type of heat sealing die, imported from Europe, which makes possible a special decorative effect on vinyl film, with different colors applied in a single heat sealing operation. According to a company official, the heat sealing process which this equipment permits is entirely new in the United States.

Officials of Cosmos are **M. S. Abraham,** formerly of Kabar Mfg. Corp., and **Gerald Lippman,** formerly of Radio Receptor Co., Inc.

Carlisle Chemical Works, Inc., Reading, Ohio, announces the acquisition of **Advance Solvents & Chemical Co.,** manufacturer of driers used in the paint and printing industries, stabilizers and plasticizers used in

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the plastics and rubber industries, and numerous specialty compounds. The company states that by this acquisition, Carlisle further expands its operations in the field of chemical additives and Advance Solvents gains access to the manufacturing and research facilities of Carlisle.

Duplicon Co., Inc., Westboro, Mass., has purchased the entire **Sheet Plastic Forming Div. of Graton Knight Co.**, Worcester, Mass. Duplicon states that the additional facilities will double the size of its own Sheet Plastic Forming Dept. which started operations in 1953.

Parkway Plastics, Inc., formerly known as O'Hara-Rowan Associates, is now located at 393 S. 21st St., Irvington, N. J.

Ansbacher-Siegle Corp., colorant manufacturer of Rosebank, S. I., N. Y., has appointed **Robert I. Knapp** and **George J. Forman** as sales representatives in metropolitan New York and Chicago, Ill., territories, respectively.

Chicago Molded Products Corp.'s Campco Div., 2721 Normandy Ave., Chicago 35, Ill., has appointed **Hugh O'Reilly** and **R. M. Lawlor** as Middle Atlantic states sales representatives.

Cooke Color and Chemical Co. has moved from Glen Rock, N. J., to Hackettstown, N. J.

F. J. Stokes Machine Co. has opened a New York district sales office at 26 E. 1st St., Mount Vernon, N. Y., under the direction of **J. C. Coleman.** The company also announces that **William J. Leighton** has joined its Philadelphia, Pa., district sales office as a sales engineer.

C. J. Osborn Co., 132 Nassau St., New York, N. Y., and Linden, N. J., has been appointed exclusive distributor for **Sachtleben Co.**, Cologne, Germany (Western Zone), producer of pure zinc sulfide, 60% concentrated zinc sulfide, and precipitated Blanc Fixe.

Suffolk Associates, 10 E. 40th St., New York 16, N. Y., has been recently formed and will act as international distributors of chemical specialties, plastic molders' materials and equipment, and machine tools. **C. P. Thuot**, formerly affiliated with Parson & Whittemore, has been named manager of the new company.

Reflin Co., manufacturer of reinforced plastic pipe, has moved its administrative and manufacturing facilities from Gardena, Calif., to the Kearny Mesa industrial district of San Diego, Calif.

Ekco Products Co., 1949 N. Cicero Ave., Chicago 39, Ill., has purchased the plastics housewares division of **Kilgore, Inc.**, Westerville, Ohio. The purchase included equipment, supplies, and inventory of Kilgore's housewares, which have been marketed under the trade name Shel-Glo.

Silveco Rubber Products, Inc., 3514 W. Fullerton Ave., Chicago 47, Ill., fabricator of soft rubber parts, has established a separate industrial division for the manufacture of cushionings made from plastic foam.

Owens-Corning Fiberglas Corp., announces that **William H. Curtiss, Jr.** has been appointed general sales manager of the company's Pacific Coast Div., Santa Barbara, Calif. **E. D. Herron**, who has been sales manager of general products of the division, has resigned to become general sales manager of **Commodore Industries**, Redwood City, Calif., manufacturer of fibrous glass reinforced plastic products.

PERSONAL

Howard S. Bunn has been elected executive vice president and a member of the executive committee of **Union Carbide and Carbon Corp.**, 30 E. 42nd St., New York 17, N. Y. He was formerly president of Bakelite Co. In April 1953, he was elected a vice president and in September 1954, a director of Union Carbide.

Dr. William Howlett Gardner, formerly with the New Products Div. of **Allied Chemical & Dye Corp.'s National Aniline Div.**, 40 Rector St., New York 6, N. Y., is now associated with the Chemical Sales Dept. of that company. Dr. Gardner will be responsible for the preparation of technical literature on National's new chemicals which include adipic acid, caprolactam monomer, isocyanates, and other organics. He will also act as a technical representative in the sale and application of National Aniline chemicals.

Dr. Hugh W. Gray has been named director of **Du Pont's** new Film Dept. Research Laboratory, now under construction at the Experimental Station in Wilmington, Del.

Dr. Frederick H. Roberts has been appointed director of research of **Bakelite Co., a Div. of Union Carbide and Carbon Corp.** His headquarters will be at Bakelite's laboratories in Bloomfield, N. J. Dr. Roberts joined Union Carbide in 1934 and since 1946 has been director of plant laboratories, Carbide and Carbon Chemicals Co., South Charleston, W. Va., another Div. of Union Carbide.

James O. Otis has been named industrial sales manager of **Continental Can Co.'s Conolite Div.**, 100 E. 42nd St., New York, N. Y. He will have his headquarters at the company's office in Wilmington, Del. Mr. Otis, formerly sales manager of National Vulcanized Fibre Co., has been in the laminated plastics field for 20 years.

Donald R. Fegley has joined Reed-Prentice Corp., Worcester 4, Mass., an affiliate of **Package Machinery Co.** He was formerly chief engineer of Consolidated Molded Products Corp., Scranton, Pa.

H. David Prior has been appointed southern California representative for **Resinite Sales Corp.**, Santa Barbara, Calif. Mr. Prior was formerly connected with Hoover Co., Santa Barbara, handling consumer sales, dealer service, and merchandising.

Frank H. Smart has joined the **Harchem Div., Wallace & Tiernan, Inc.**, 25 Main St., Belleville 9, N. J., as assistant to the director of sales. He was previously associated with Whittaker, Clark & Daniels, Inc. as an area sales manager.

Julius C. Hydrick has been named works manager of **Quaker Rubber Corp., Div. of H. K. Porter Co., Inc.**, Philadelphia 24, Pa. Mr. Hydrick was formerly works manager of Quaker from June 1950 to Novem-

THE PLASTISCOPE

ber 1951, when he was transferred to another Porter division, Delta-Star Electric Co., Chicago, Ill., as works manager.

Lloyd C. Adam has returned to **Erie Engine & Mfg. Co.'s Plastics Machinery Div.** as sales manager after an absence of a year and a half.

Arthur B. Sherry is now sales manager of **Stanley Chemical Co.**, East Berlin, Conn.

Gordon Kiddoo, formerly director of the Development Dept., is now vice president in charge of development of **National Research Corp.**, 70 Memorial Dr., Cambridge 42, Mass. His former affiliations were with Hydrocarbon Research, Inc., The Texas Co., and Continental Carbon Co.

W. J. Vogel, formerly Western regional sales manager, has been appointed general sales manager of **Reynolds Metals Co.'s Plastics Div.** His headquarters will be located at 400 N. Michigan Ave., Chicago, Ill.

Donald F. Pethybridge has joined **Reed Plastics Corp.**, 116 Gold St., Worcester 3, Mass., as chief chemist.

Robert J. Boyden, formerly associated with Morningstar Corp., has joined the engineering department of **E. B. Kingman Co.**, Leominster, Mass.

Edmond J. d'Angio has joined the sales organization of **Jersey Plastic & Die Casting Co.**, 149 Shaw Ave., Irvington 11, N. J. to promote its sales of custom molding and die casting. He was previous affiliated with Spill Mfg. Co. as sales manager, and with Columbia Protektosite Co., Inc.

Julius M. Medwin has been named assistant to the vice president of **Bassons Industries Corp.**, 1432 W. Farms Rd., Bronx, N. Y.

Dr. William C. Dearing is now technical director of **Glaskyd, Inc.**, 125 W. 3rd St., Perrysburg, Ohio.

Max Wohlleben has been promoted to chief engineer and sales director of **Newark Die Co., Inc.**, 20-24 Scott St., Newark 2, N. J. According to Islyn Thomas, general

manager, he will head four operations covering sales, custom service, estimating, and engineering. Mr. Wohlleben joined Newark Die 20 years ago and has been in the tool and die-making industry for over a quarter of a century.

Raymond J. O'Hara has joined **Synthetic Products Co.**, 1636 Wayside Rd., Cleveland, Ohio, as chief chemist.

Edward Van Romer has joined **Raffi & Swanson, Inc.**, 100 Eames St., Wilmington, Mass., as sales and service representative covering central and western New York and Pennsylvania.

Dr. A. Ross Adams has been promoted to assistant to **Dr. Herschel H. Cudd**, vice president of research and development of **American Viscose Corp.**, 1617 Pennsylvania Blvd., Philadelphia 3, Pa. Dr. Adams, a research chemist, will be located at the company's research center in Marcus Hook, Pa.

Jean O. Reinecke, head of **Reinecke and Associates**, 155 E. Ohio St., Chicago, Ill., staged an informal buffet and cocktail party in his offices on March 29 to celebrate his 20th year as an industrial designer. Mr. Reinecke is well known in the plastics field for the many design projects he has directed involving plastics materials, and has been an active participant in industry organizations.

MEETINGS

May 23-25—American Society for Quality Control, Ninth Annual Convention, Hotels Statler and New Yorker, New York, N. Y.

June 1-11—British Plastics Federation, British Plastics Convention and Exhibition, National Hall, Olympia, London, England. Applications for tickets should be made to British Plastics Exhibition, Associated Iliffe Press, Dorset House, Stamford St., London S.E. 1, England, stating for which sessions they are required.

June 2-3—Institute of Radio Engineers, Materials Symposium, The University of Pennsylvania, Physics Building, Room A1, Philadelphia, Pa.

June 26-July 1—American Society for Testing Materials, Fifty-eighth Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

CLASSIFIED ADVERTISEMENTS

MODERN PLASTICS reserves the right to accept, reject or censor classified copy.

EMPLOYMENT • BUSINESS OPPORTUNITIES • EQUIPMENT (used or resale only)

MACHINERY and EQUIPMENT FOR SALE

LEOMINSTER 8 oz. Injection Molding Machine. Plastic and Rubber Equipment. Farrell 16"x48", 15"x36" and 6"x12", 2 roll mills. Mills and Calenders up to 84". New Seco 6"x12" and 6"x16" Lab. Mixing Mills and Calenders. Rubber Plastic Extruders Wat.-Stillman 75 ton automatic Molding Press 20"x20" platens. 200 ton Hobbing Press 18"x14" platens. HPM 200 ton 30"x48" platens. New Loomis 340 ton. 24"x56" platens. 200 ton Brunswick 21"x21" platens, 14" ram. 150 ton Bolling 20"x20" platens. Southwark 30 ton 14"x14" platens, semi-auto. Also Lab to 2000 tons from 12"x12" to 48"x48". Hydr. Oil Pumps. Gould 75 HP motor Dr. 2 stage Centrif. Pump 250#. W.S. 4 Plgr. High and Low Pressure Hydr. Pump. Elmes Hor. 4 Plgr. 4500 lbs. and 5500 lbs. Hydr. Accumulators. Stokes Automatic Molding Presses. Rotary & single Punch Preform Tablet Machines ½" to 4". Injection Molding Machines 1 oz. to 32 oz. Baker Perkins Jacketed Mixers. Plastic Grinders. Heavy duty mixers, gas boilers. Partial listing. We buy your surplus machinery. STEIN EQUIPMENT CO., 107-8th Street, Brooklyn 15, N.Y. STerling 8-1944.

SAVE WITH GUARANTEED REBUILT EQUIPMENT: 2 new R. D. Wood 500 ton embossing presses; 54"x26" platen, HYDRAULIC PRESSES; 40"x54", 36" ram, 1500 tons; 30"x26", 16" ram, 600 tons; 2—27"x27", 18" rams, 585 tons; 20"x20" 10" ram, 200 tons; 20"x20", 14" ram, 200 tons; 15"x15" 8" ram, 75 tons; 14"x14" 8" ram, 75 tons; 2—19"x24" 10" rams 78 tons; 18"x18," 7" ram, 50 tons; 10—26"x26" 7" rams, 50 tons; 12"x12" 7½" ram, 50 tons; 14"x14" 8" ram, 50 tons; 8"x9½" 4½" rams 20 tons; 16"x16" 3½" rams, 12 tons; Carver model 150 and 6"x 6". LABORATORY PRESSES; Stokes Model T, late type with drive; Stokes Model T, late type with hydraulic equalizer system and drive; Colton 5½T with drive PREFORM PRESSES; NEW UNIVERSAL DUAL PUMPING UNITS 3—15 HP; NEW LABORATORY MILLS and CALENDERS; HPM 6" ram, 2500# pressure ACCUMULATOR; also Extruders, Mixers, Vulcanizers, Injection Molding Units, etc. UNIVERSAL HYDRAULIC MACHINERY COMPANY, INC., 285 Hudson Street, New York 13, N. Y.

FOR SALE: 3—National 10"x20", 6"x14" Two Roll Mills; 1—Baker Perkins 100 gal. S.S. double arm, jacketed Vacuum Mixer; 3—Baker Perkins 100 gal., 50 gal. jacketed double arm Mixers; 2—Stokes Rotary Preform Presses DD2, D3; 1—Stokes Model "R" single punch Preform Press; 1—Kux Model 15-25 double action Rotary Press; 2—Cumberland #0 Rotary Cutters; Also: Sifters, Cutters, Banbury Mixers, etc., partial listing; write for details; we purchase your surplus equipment; BRILL EQUIPMENT CO., 2407 Third Ave., New York 51, N. Y.

AVAILABLE AT BARGAIN PRICES
Mitts & Merrill 15CD Rotary Cutter, J. H. Day, from ¾ up to 100 gal., Imperial and Cincinnatus D.A. Jacketed, Sigma Blade Mixers. Day 15 to 10,000 lbs. Dry Powder Mixers. Baker Perkins Heavy Duty Steam Jacketed, Double Arm, from 5 to 200 gal., Mixers (Unidor and Vacuum also). Gemco 2000 lb. 56 cu. ft. Double Cone Blender. Mikro Bantam 1SH, 2TH, 3W, 4TH Pulverizers, Rotex, Tyler Hum-mer, Robinson, Raymond, Gayco, Great Western Sifters. Colton 2 RP and 3 RP Rotary & #5½ Tablet Machines. Carver Laboratory 20 ton Hydraulic Press. Package Machy. FA, FA2, FA4, U4. Miller, Hayssen, Wrap-King, Scandia, Oliver Auto. Wrappers—all sizes. This is only a partial list. Over 5000 machines in stock available for immediate delivery. Tell us your machinery requirements.
UNION STANDARD EQUIPMENT CO.
318-322 Lafayette St., New York 12, N.Y.

FOR SALE: Stainless Steel Rotary Dryer. Link Belt Co., 5'2" x 16". No. 502-16, with all auxiliary equipment. Roto Louvre also 6' x 24' and 5' x 26'. Hersey Stainless Steel Rotary Driers. Reply Box 63055, Modern Plastics.

FOR SALE: (11) 75 ton record presses, complete @ $2,450, (11) new 100 ton, 10" ram, 10" stroke @ $1,100, (8) 200 ton, 9" stroke, 14" ram, 36x36 @ $1,850, (7) 200 ton, 9" stroke, 15" ram, 30x30 @ $1,650, (1) 50 ton complete, 18x18 @ $1,850, (1) 200 ton, 16" ram, 30x30 @ $2,450, (2) 200 ton, 16" ram, 42x42 @ $2,850, (1) 260 ton, 15" ram, 42x42 @ $2,450, (4) 250 ton, (2) 12" rams, 50x60 rebuilt @$3,375. HYDRAULIC SAL-PRESS CO., INC., 388 Warren Street, B'klyn, N. Y.

FOR SALE: Hobbing Press 800 Ton W.S. (2) 300 Ton W.S. Presses 20x20 & 29x24 Platens. 140 Ton W.S. 22x16 Platen. 85 Ton Waterbury Farrel 20x24 Platen. 63 Ton Press 15x15 Platen with Pullback Cyls. 9, 8, 4, Oz. Injection Molding Machines. 15 Ton Lab. Presses 10x8 Platen. 10 Ton Lab. Presses 6x6 Platen Ball & Jewell Plastic Grinders. Standard Mystic Embossing Presses. Accumulators, Pumps, Valves. Many other Presses—Send For Bulletin. AARON MACHINERY CO., INC., 45 Crosby St., New York 12, N. Y. Tel. WAlker 5-8300.

FOR SALE: 1—F.B. 32"x92" Inverted-L 4 Roll Calender, reduction drive, d.c. vari-speed motor; 1—Royle #4 Extruder, motor driven; 1—6"x12" Laboratory Mill, m.d. 1—Farrell-Birmingham 6"x13" 3 Roll Calender; 1—Ball & Jewell Rotary Cutter, Model 251, m.d.; 2—Baker-Perkins Size 15, 100 gal. Jacketed Mixers; 5—Horizontal Dry Powder ribbon Mixers, 4000#, 1500#, 500#; 1—New 3 Roll 6"x16" Laboratory Calender; 1—Farrell-Birmingham 60" Mill with reduction drive, 150 HP motor, floor level mounting; 1—Fitzpatrick "D" Comminutor, S.S. contact parts, jacketed; 1—Mikro Pulverizer #2th, with motor; 4—Reed Prentice & W-S Injection Molding Machines, 2-16 oz.; 4-Hymac 125 ton Molding Presses, 16"x16" electrically heated platens. Also other sizes: Hydraulic Presses, Tubers, Banbury Mixers, Mills, Vulcanizers, Calenders, Pellet Presses, Cutters. Send us your inquiries. What have you for sale? CONSOLIDATED PRODUCTS CO., INC., 50 Bloomfield Street, Hoboken, N.J. HOboken 3-4425. N. Y. Tel. BArclay 7-0600.

FOR SALE: 60 oz. H.P.M. 48 oz. Lester, $45,000. 40 oz. H.P.M., $28,000. 32 oz. Lester, 1950, $22,000. 32 oz. Reed-Prentice, 1950, $26,000. 22 oz. Reed-Prentice, 1947, w/plunger advance, $13,500. 22 oz. Reed-Prentice, 1945, excel., $11,000. 16 oz. H.P.M., $9,500. 16 oz. Watson-Stillman, $16,500. 12 oz. Reed-Prentice, 1950, $10,500. 12 oz. Lester, $5,000. 12 oz. Watson-Stillman, 1948, $10,000. 8 oz. Reed-Prentice, 1946, $6,500. 8 oz. DeMattia, $4,500. 8 oz. Lester 2½L, $5,500. 8 oz. Reed-Prentice w/10 oz. cyl., $8,500. 8 oz. Leominster, $5,000. 6 oz. Reed-Prentice, $3,500. 6 oz. Lester, $4,000. 6 oz. DeMattia, $3,250. 6 oz. Heisgen, $2,500. 4 oz. H.P.M., $3,350. 4 oz. Reed-Prentice, 1948, $5,200. 4 oz. Impco, $6,850. 4 oz. Lester, $3,000. 4 oz. Lester, Vertical, $4,500. 3 oz. Fellows, $6,500. 2 oz. Dowding & Doll, $3,350. 2 oz. Reed-Prentice, $1,350. 2 oz. DeMattia vert., $750. 3¼" Hartig extruder, $2,500; new powder mixers, $315; 150 ton closure presses; 6 tray oven, $150; 80 ton transfer & compression press, new, $4,250; #235-A Stokes. ACME MACHINERY & MANUFACTURING CO., 102 Grove Street, Worcester, Mass. Tel: PLeasant 7-7747.

FOR SALE: Blaw-Knox 15 gallon Resin Kettle Pilot Plant, type 347 stainless steel, jacketed and agitated, 150# pressure with Condenser and Receiver, Variable speed drive, Controls, etc. Excellent condition. Also #1½ B & J Stainless Steel Cutter and 2—Kux Model 25 Rotary Presses. PERRY EQUIPMENT CORP., 1429 North 6th Street, Philadelphia 22, Pa.

FOR SALE: One 300 Ton Stokes Standard Hydraulic Molding Press with bar control—self contained—excellent condition. Price $8,000.00. MOLDED PLASTIC BUTTON CORPORATION, 63-17 Rockaway Beach Blvd., Arverne, New York. Tel.: NE-4-4207.

VACUUM FORMING MACHINE: New 2 table unit—32 x 53 size. Complete with all timers, controls and pumps. Can be bought cheap. Write Box #631, Peabody, Mass.

COMPLETE PLASTIC BUTTON MOLDING PLANT: 1—Stokes 200 Ton Model 250-A Semi-automatic Press, 2—Stokes 150 Ton Model 250-A Semi-automatic Presses, 3—Stokes RDS-3 Rotary Tablet Machines, 3—MKO 2 HP, 150 PSI Gas Boilers, 3—Buttondex Broaches, Definners, Inspection Conveyors, Tumbling Barrels, 18, 22, 24, 30 Ring Fisheye, Poker Chip and Electric Plug Molds, etc. Other Hydraulic Presses: Erie 4000 Ton and Baldwin-Southward 3600 Ton Belt Presses. Birdsboro 2000 Ton, Farrell 1000 Ton, HPM 750 Ton, Erie 700 Ton, Baldwin-Southwark 400 Ton, Farrell 393 Ton and 200 Ton, Watson-Stillman 110 Ton and 100 Ton, HPM 100 Ton and 35 Ton Molding Presses and Watson-Stillman 30 Ton Lab Presses. INJECTION MOLDING MACHINES: Various Makes, 2 oz. to 22 oz. EXTRUDERS: No. 1 Royle and larger. MISCELLANEOUS: Lab Mixers and Mills, MPM Pelletizer, Rotary Cutters, etc. JOHNSON MACHINERY COMPANY, 683P Frelinghuysen Avenue, Newark 5, New Jersey, Bigelow 8-2500. What have you for sale? What are you looking for?

FOR SALE: 1—National Erie 8½" strainer; 2-Stokes Model 294 Preform presses, 4" dia.; 2—880 ton self-contained compression molding presses; 1—HPM hydropneumatic accumulator, 6" ram, 200/3100#; 2—16" x 40" rubber mills, each with 40 HP motor; also presses, extruders, mills, mixers, et cetera. CHEMICAL & PROCESS MACHINERY CORP., 146-148 Grand St., New York, N.Y.

FOR SALE: 200 T. HPM Fastraverse Fiberglass Press & Williams Preformer. Injection Presses: 4, 8, 12, 16, 24, 32 oz. Reeds, 6, 8, 12 oz. Lester. 9 oz. HPM. 4 oz. Lewis. 1 & 2 oz. Van-Dorn. 1—complete Injection Plant w. 6 press. bldg., vct. lot, exc. moneymaker. Scrapgrinders. Ovens. Compression presses: 50, 100, 150, 600 tons, including Stokes-Standard. Preformpresses. 25 HP Gasboiler. Equipment to be inspected in operation (Midwest). List your surplus equipment with me. JUSTIN ZENNER, 823 Waveland Ave., Chicago 13, Ill.

FOR SALE: One Reed-Prentice 24 ounce Injection Molding Machine. Fully equipped with 40 H.P. motor, Wheelco instruments, timers, etc. This machine is in very good condition, has had excellent maintenance and can be seen running in regular production anytime before June 15, 1955. PLASTIC MOLDED PRODUCTS CO., 6044 N. Pulaski Rd., Chicago 30, Illinois.

FOR SALE: Two HF electronic heat sealing generators and presses (1) General Oscillator and (1) Vetric both 6KVA 60 cycle 3 phase 220-440. PEEK-A-BOOT, INC., 1604 South Flower Street, Los Angeles.

FOR SALE: 1 Kux 30 Ton Model 60 Preform Press. Running Condition. A good second Preformer. Price less drive $1,500.00. Write or wire WAHL CLIPPER CORP., Sterling, Illinois.

MACHINERY and EQUIPMENT WANTED

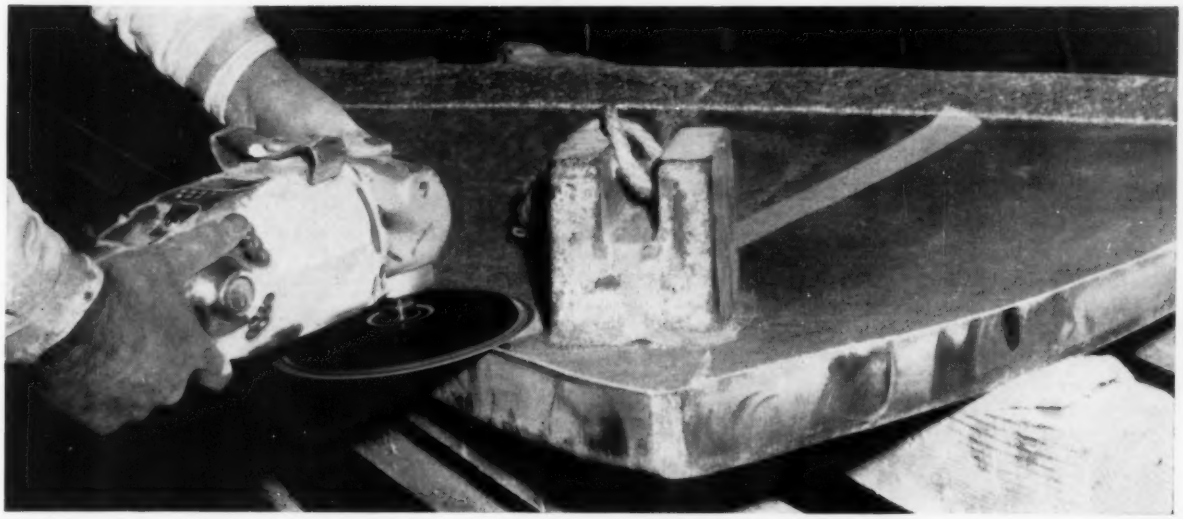
WANTED: Machinery including Rubber Mills, Hydraulic presses, Study mixers, Calenders, Banbury mixers, Pulverizers, Grinders, Rotary cutters, Extruders, Screens, Injection Molding machines, Dryers. Will purchase complete plant. CONSOLIDATED PRODUCTS CO., INC., 50 Bloomfield Street, Hoboken, N. J. HOboken 3-4425. N. Y. Tel.: BArclay 7-0600.

WANTED: 750 ton and 1000 ton self contained compression molding presses. Give complete specifications and price. ABLE ENGINEERING COMPANY, 47 Crosby Street, New York 12, N. Y. Tel.: WAlker 5-8300.

WANTED: Embossing rolls, 60" to 76" Face, 6" to 12" diameter Water cooled. Also chilled roll up to 24" diameter 60" to 76" Face. T&M MACHINE & TOOL CO., 15-17 Greenpoint Ave., B'klyn. 22, N.Y. Tel.: EVergreen 9-1964.

(Continued on page 278)

● Surfacing reinforced plastic boat deck with 80-grit silicon carbide abrasive cloth disc on Flexbac® Pad.



● Cutting down edges of reinforced plastic mould with Resin Sander Disc.

FASTER SANDING *of edges and contours on fiber-reinforced* PLASTICS

● Let CARBORUNDUM's abrasive "know-how" work for *you*... use these two cost-cutting, time-saving abrasive techniques specially designed for grinding and finishing glass fiber-reinforced plastics:

1. **RESIN SANDER DISCS,** made from sharp, top-quality aluminum oxide abrasive grain, are unequalled for cutting down mould marks, smoothing rough edges. They cut faster, stay uniformly sharp from start to finish...give you much more work per disc!
2. **FLEXBAC® PAD ASSEMBLY,** with its thick, foam-rubber pad, follows contours—both concave and convex—better than any other mechanical tool. Pad attaches to any portable air or electric drill or polisher...discs are held fast with pressure-sensitive adhesive—can be removed and replaced quickly.

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Dept. MP 82-514, Niagara Falls, New York

Please send your folder on "Grinding Glass Fiber-Reinforced Plastics."

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REGISTERED TRADE MARK

FIRST *with the* **BEST** *for grinding-finishing fiber-reinforced* **PLASTICS!**

82-514

CLASSIFIED ADVERTISING

(*Continued from page 276*)

WANTED: Used F. J. Stokes Machine Company tablet presses, single punch type. Required for own use. Reply Box 60655, Modern Plastics.

WANTED: Waldron or equivalent reverse-roll coater; minimum width 60". Apply to: ALLIED TAPE CORPORATION, 92 Brookline Street, Lynn, Mass.

WANTED: Used Hydraulic Compression Molding Press; 150 ton capacity; hydraulic system optional. Platen size must be capable of taking a 43" x 43" die; high and low pressure systems; shut height 7 inches or less preferred; automatic cycle control. TEMCO, Inc., 4104 Park Avenue, Nashville, Tennessee.

WANTED: PLASTIC VACUUM FORMING MACHINE for forming of plastic sheeting. Work table approximately 45" x 21". Reply M 642 ANNONCEN-EXPEDITION JAK, Vowinckel, Bielefeld, Germany.

WANTED: Van Dorn Plastics Injection Press, 1 oz. Model H-200, also Laboratory 2 roll Plastic Mill. Full details as to age, amount of use and condition. KENTUCKY COLOR & CHEMICAL CO., 600 N. 34th St., Louisville, Kentucky.

WANTED: One (1) Aldrich Pump Company 1" x 3" Triplex Inverted Pump, 20 H.P., 220V Motor—10 GPM—3000 #PSI Water Service. Reply Box 63255, Modern Plastics.

WANTED: LARGE PLATEN HYDRAULIC PRESS Platens 36" x 72" or larger. Single or multiple opening. 300 ton minimum pressure. Steam or electrically heated. Reply Box 63755, Modern Plastics.

WANTED: 32 or 48 oz. Watson-Stillman Injection Molding Machine, prefer late model, good condition. LINCOLN PLASTICS CORP., 13 Marshall Street, South Norwalk, Conn.

MATERIALS FOR SALE

FOR SALE: 23952 feet of clear lucite tubing .585 O.D., .490 I.D., 36" long, approximately 1000#. 16200 feet of black lucite tubing .580 O.D., .475 I.D., 36" long, approximately 675#. 15795 feet black lucite tubing .580 O.D., .475 I.D., 31¾" long, approximately 650#. All items priced at .15 per lb. BLAKE MANUFACTURING DIVISION, Ray-O-Vac Company, Clinton, Mass.

FOR SALE: 20,000 lbs. each Red and Blue Styrene Pellets. Surplus lot Red Acetate Pellets—15,000 lbs. Both attractively priced. We are also in the market for all surplus plastic scrap and powder. PLASTIC MOLDING POWDERS, INC., 2004 MacDonald Avenue, Bklyn., N. Y. Tel.: ES 5-7943.

NYLON SHAVINGS: Regular quantities available. WANDEX PLASTICS LTD., 23 Pitfield Street, London, N.1., England. Cables—Ardonplast. London.

FOR SALE: High Impact Polystyrene. You can save money by using our reprocessed high impact polystyrene pellets available in a variety of bright colors as well as matched colors. Also, bargains in bright colors cellulose acetate and other thermoplastics. Samples on request. A. BAMBERGER CORPORATION, 703 Bedford Ave., Brooklyn 6, N.Y., Telephone MAin 5-7450.

VINYL COATING SOLUTION: Large Quantity Available. Light Grey color, containing VYHH, VYNS, DOP, Acryloid B72, solvent, priced below raw materials cost. ACETO CHEMICAL CO., INC. Flushing 54, N.Y. Tel.: INdependence 1-4100.

MATERIALS WANTED

CLEAR ACRYLIC MOLDING POWDER SCRAP wanted by end user either reground or unground. Also nylon molding powder scrap needed. Highest cash prices paid. Reply Box 61455, Modern Plastics.

WANTED: Plexiglas and Lucite scrap, salvage and cut-offs, any quantity. DUKE PLASTICS CORP., 584 Broadway, Brooklyn 6, N. Y. Tel.: EVergreen 8-5520. Note new address!

INTERESTED IN PURCHASING odd lots of resin and off resin. Any quantity, large quantities preferred. Reply in detail sending samples and identify material offered. Reply Box 61955, Modern Plastics.

SELL US YOUR PLASTIC SCRAP. Polyethylene, Polystyrene, Acetate, Ethyl Cellulose, Acrylics, Butyrate, Nylon. GEORGE WOLOCH, INC., 82 Beaver St., New York 5, N.Y.

WANTED: Plastics Scrap and Rejects of all kinds, ground and unground. Also rejected molded pieces and surplus virgin molding powders. Top prices paid. A. BAMBERGER CORPORATION, 703 Bedford Ave., Brooklyn 6, N. Y., Telephone MAin 5-7450.

SCRAP PLASTICS, all forms, waste and surplus plastic molding materials, rejects in any form. We will also buy your obsolete inventories of molding powders, stabilizers, plasticizers and other plastic and chemical materials. ACETO CHEMICAL CO., INC., 40-40A Lawrence St., Flushing 54, N. Y. INdependence 1-4100.

MOLDS FOR SALE

FOR SALE: One 8-Cavity Compression type plastic mold, one year old, to produce handles for broilers, grills, rotisserie, frying pans, etc. For further information write Box 62855, Modern Plastics.

MOLDS WANTED

WISH TO PURCHASE Injection Mold for Chess Figures. MAKRAY MANUFACTURING COMPANY, 1419 West Diversey Parkway, Chicago 14, Illinois.

MOLDS WANTED: We are interested in purchasing molds of Radio and Television and Instrument Knobs that you no longer use. We are also interested in Radio and Television Knobs that you have molds for and can supply. Send us samples or prints. Write GEE-LAR MFG. CO., 819 Elm St., Rockford, Illinois.

WE ARE INTERESTED in acquiring molds for export to European countries, either inactive, or active with license, to produce abroad. Interest is for novelties, toys, kitchen articles, utensils, etc. Offers with specifications, prices and samples where available, will be submitted to our clients for prompt action. Please address replies to HARRY KRIEGER COMPANY, 152 West 42 Street, New York 36, N.Y.

PLANT FOR SALE

FOR SALE
Complete wood flour mill. Capacity 10 tons per 24 hours, using nearby supply of pine and poplar. For further particulars, reply Box 61855, Modern Plastics

HELP WANTED

PLASTIC DEPT. MANAGER: Man to manage medium size plastic molding dept. Must have supervisory exp. in both compression and injection molding. Must be thoroughly familiar with and capable of supervising and advising on all problems relating to plastic molding dies and equipment. This is an invitation for an experienced, high caliber man to join a sound organization with a good background and an excellent future. Contact Mr. Evans or Mr. Theis at MAYFAIR MOLDED PRODUCTS CORPORATION, 4440 N. Elston Ave., Chicago 30, Illinois.

FLOOR TILE CHEMIST WANTED
Experienced manufacture Vinyl Tile. Good salary, liberal insurance, hospitalization and retirement. Replies will be confidential. Reply Box 61255, Modern Plastics.

INJECTION SALES EXECUTIVE: Large established Midwest custom molder has immediate opening for sales manager, administrator, or engineer with heavy experience in thermoplastics. Write full details including salary to Box 60855, Modern Plastics.

VINYL COMPOUNDER
Opening now exists in our Chemical Development Division for a qualified vinyl compounder with formulation and processing experience in calendering or extrusion. Applicant must have a minimum of a BS degree in Chemistry or Chemical Engineering and five years industrial experience. Work will include product compounding, polymer evaluation, development of sales literature, and technical sales service on vinyl resins. Permanent location in Akron, Ohio. Reply should give details of education and experience and should include salary required. R. N. Whitcomb, Sales & Office Personnel 806-2J, GOODYEAR TIRE & RUBBER CO., 1144 East Market St., Akron 16, Ohio.

REINFORCED PLASTICS ENGINEER with particular experience in honeycomb structures to take charge of production and development program. Wonderful opportunity for top man. Salary commensurate with ability. Send resume and salary requirements to Box 60255, Modern Plastics.

CHEMIST: VINYL COATING
Require chemist experienced plastisol formulations for fabric coating operation. Good opportunity. All replies confidential. Our employees know about this ad. Reply Box 61155, Modern Plastics.

WANTED: AMBITIOUS CHIEF ENGINEER for large Eastern custom molder. Imagination and initiative—experienced in plastic mold design, secondary tool design, knowledge of various molding materials and estimating. Excellent opportunity to work with top management in developing new outlets for plastics. Send complete resume with past salaries and desired salary; also photograph if available. Must be willing to relocate. For right man a wonderful opportunity is available. Reply Box 60155, Modern Plastics.

CHEMICAL ENGINEER OR CHEMIST
Engineer with several years experience working in the field of glass reinforced moldings and laminates. Must be thoroughly familiar with all types of resins and filler systems. Will be engaged in development of new materials and fabricating techniques and will be required to work with an aggressive competent group of Engineers and Technicians. Experience with the requirements of the electrical industry helpful. Salary open. All replies held strictly confidential. Send complete resume including present salary to Dr. G. C. Gainer, WESTINGHOUSE ELECTRIC CORPORATION, Materials Engineering Department, East Pittsburgh, Pennsylvania.

PLASTICS ENGINEER: Research and development engineer or chemist experienced in formulation and usage of inorganic colorants for resins. Our employees know of this opening. Reply Box 61655, Modern Plastics.

PLASTICS ENGINEER
Production and Development Engineer; experienced in formulation, evaluation and competitive analysis of all phases of dry blends and conventional extrusion compounds, plastisols, surface coatings, adhesives and sealers. Plant is located in Northwestern Ohio. Reply, stating age, education, experience and salary requirements. Reply Box 62055, Modern Plastics.

WANTED: Expert in production of Acrylic and Polyester sheets for buttons to set up plant in Mexico City. Reply: P.O. Box 461, México 1, D. F. MEXICO.

CHEMIST OR CHEMICAL ENGINEER
for research and development work on micaceous insulation products, laminated plastics, and coated fabrics for electrical insulation. About five years of experience in the field of adhesives, varnishes, and synthetic resins preferred. Location Eastern New York. Please state education, experience, references, salary desired and photo, if available, with initial letter. Reply Box 62155, Modern Plastics.

(*Continued on page 280*)

CLASSIFIED ADVERTISING

(*Continued from page 278*)

EXTRUSION AND VACUUM FORMING ASSISTANT PLANT SUPERINTENDENT AND SECOND SHIFT SUPERINTENDENT: A new corporation in a new modern plant in the Chicago area. Applicants should have experience in polystyrene sheet extrusion and/or vacuum forming with good mechanical aptitudes. These are permanent positions with very good remunerations and excellent opportunities for advancement and growth. Reply Box 62955, Modern Plastics.

REINFORCED PLASTICS ENGINEER
Prefer man with Chemical or Chemical Engineering background for opening in development or project engineering group. Permanent position with excellent advancement opportunities and employee benefits in leading company in this field. Send resume including education, age, experience and salary requirements to: Manager, Salaried Employment, THE BRUNSWICK-BALKE-COLLENDER CO., Marion, Virginia.

EXTRUSION, VACUUM AND PRESSURE FORMING ENGINEER: To develop new products and processes. Protective coatings experience helpful but not essential. Chicago location with a leader in its field. Apply in confidence to Box 63555, Modern Plastics.

VINYL CHEMIST
Experienced heavy or light gauge calendering. Good salary, liberal insurance, hospitalization and retirement. Replies treated confidentially. Reply Box 61355, Modern Plastics.

ENGINEERS — SALESMEN — ADMINISTRATORS — EMPLOYERS: Confidential, rapid and professional service for nation wide placement in the Plastics field. Write giving age, education and brief experience. Employers send us job description. We will let you know how we can help you by return mail. GRAEBNER'S PLASTICS EXCHANGE "The Nation's Largest", 116 South Michigan, Chicago 3, Illinois.

TECHNICAL DIRECTOR
In charge of quality control, research and development. Challenging position with well-established, fast-growing manufacturer of molding powders, polymers, resins and plastics. $10,000-$13,000. Reply Box 63855, Modern Plastics.

SITUATIONS WANTED

PLASTICS ENGINEER: Chemical engineering degree from top school, graduate training in business administration. Six years diversified experience in high polymers. Thoroughly familiar with all phases of thermoplastics from formulation to customer service. Resourceful, pleasingly aggressive, ambitious, dependable. Desires responsible position with future in Boston area. Reply Box 61055, Modern Plastics.

SALES ENGINEER—CUSTOM INJECTION MOLDING: Desires position with efficient, progressive molder. Young, aggressive, 10 years uninterrupted experience in the field. Substantial following among industrial and consumer accounts. Creative sales personality and sales promoter. Thorough knowledge all production problems. Plant to be located Greater New York area. Salary plus commission or drawing against commission, Reply Box 60555, Modern Plastics.

GENERAL PLANT SUPERINTENDENT
14 years experiences in all phases injection, compression, transfer molded plastic products. Set ups, maintenance, electro-mechanical, steem controls, layouts, supervising tool shop making molds. Personnel, technical personnel, high efficiency in production, quantity-quality controls. Reply Box 61555, Modern Plastics.

COATING: Direct and transfer method, sheet or web, paper, plastics, films, knit and woven fabrics, plastic foam, plastisols, organosols, heat seal coatings, release coatings for pressure sensitive adhesives. **LAMINATING:** Sheets and web, paper, plastic films, plastic foam, fabrics, emulsions, lacquers and hot melt adhesives. Presently employed, but seeking greater opportunities. Willing to re-locate. Reply Box 61755, Modern Plastics.

REINFORCED PLASTICS ENGINEER: Fully experienced in bag-molding, hand layups, Marco molding, corrugated sheet laminating and fiberglas mat production. Capable of engineering, building and managing operation of specialized processing equipment. M.I.T. graduate. Seeking responsible position with established concern. Reply Box 60455, Modern Plastics.

PROJECT ENGINEER with 5 years experience developing Latex and plastic products from the conception of an idea through the development and initiation of production processes, is seeking employment in a concern where imagination and creative ability are in demand. Reply Box 62655, Modern Plastics.

REINFORCED PLASTICS ENGINEER: Extensive technical background in all phases of design, estimating, customer contact, prototype and production of mat, preform and premix. Supervisory experience in injection & compression molding, finishing operations, production & inventory control. Experienced in plastics tooling, utilizing temporary molds for production of reinforced plastics. Desire challenging position. Married, 29, able to relocate. Reply Box 62355, Modern Plastics.

MANUFACTURER'S REPRESENTATIVE: Capable sales engineer well established Columbus-Louisville area will represent financially sound midwest molder preferably doing both injection and compression molding plus metalizing and decorating. Have wide experience in vacuum forming and solicit representation only with companies who extrude own sheet. Excellent contacts among appliance manufacturers. Principals should have large volume capacity. Cincinnati resident. Reply Box 62555, Modern Plastics.

ENGRAVER wishes employment by progressive molder or moldmaking shop, to establish engraving department. All moldwork, cavities, cores, hobs. Top experiences in all phases of machining operation to final diamond finishes to precision requirements. Economically minded, supervisory and managing experience. Able to secure additional reliable help. Chicago area. Reply Box 62755, Modern Plastics.

REINFORCED PLASTICS CHIEF ENGINEER: BSME, age 39, 15 years experience in design, development and manufacture of reinforced plastics—closely related products. Thoroughly experienced in all methods and materials. Products include aircraft and missile components, radomes, shipping containers, boats, tubing and furniture. Presently Chief Engineer—Plastics aircraft products manufacturer. Seek increased opportunity and compensation. Any phase of business. Reply Box 62455, Modern Plastics.

SALES AGENTS WANTED

AGENTS WANTED: Custom molder specializing in all forms of Fluoro Carbon Plastics, including impregnations of Fiberglass, Iron, Asbestos, etc. plus Resilient Core "O" Rings, Valve Seats & Diaphragms, has several territories open in the New England, W. Penna., Chicago-Cleveland-Detroit, Mid-West & South and West Coast areas. Commission basis. FLUORO PLASTICS, INC., 4546 Baker Street, Philadelphia 27, Pa.

MANUFACTURERS' REPRESENTATIVE WANTED to handle line of extruded plastics, mainly vinyl. Established accounts will be turned over to representative. Territories open: New York metropolitan, Michigan, Indiana and Ohio. Reply Box 62255, Modern Plastics.

SALES REPRESENTATIVES for one of the country's leading manufacturers of molded packaging. We are only interested in agents who will handle our line of containers exclusively. Liberal commissions and protected territories, Chicago, and points West. Reply Box 63355, Modern Plastics.

SALES AGENTS WANTED: Established custom injection molder in Great Lakes area wishes to expand field of operations. Over 15 years know-how in all thermoplastics. Seeks commission representatives with industrial contacts. Familiarity with molding process desirable. Agents with proprietary plastics item can greatly increase income. Most territories open. Reply Box 63155, Modern Plastics.

OHIO REPRESENTATION: Foremost supplier of metallized acetate, polystyrene, butyrate and Mylar sheeting seeks aggressive representation to contact vacuum formers, laminaters point-of-purchase display houses and other users of metallized sheeting. Reply Box 63955, Modern Plastics.

SALES REPRESENTATIVE wanted by custom compression and plunger transfer molding company. We are interested only in men of proven ability who are now calling on industrial accounts. Modern plant located in Southeast Missouri with modern and up to date facilities. Desirable territories open—commission basis. Reply giving experience, present lines, and territory wanted to Box 60755, Modern Plastics.

MANUFACTURER of rigid plastic sheets seeks manufacturer's representative for new line of optically clear, Cast Acrylic Sheets. Position requires calls on distributors, fabricators and end users. Enterprising salesman can attain high earnings with product much in demand. Commission basis. Reply Box 63455, Modern Plastics.

MISCELLANEOUS

INTERESTED IN PURCHASING: Dimethyl Phthalate, Diethyl Phthalate, Tricresyl Phosphate, Ortho-Nitrobiphenyl, Ethox Methox, Di Carbitol, Pycal 94. PEERLESS CHEMICAL CORP., 181 Greene Street, N.Y.C. 12.

MANUFACTURERS' AGENT covering all of New York state excluding New York City is seeking a custom molded plastics line. Well established and has excellent contacts among industrial purchasing agents. Calling on electronics, automotive and diversified industries with allied lines. Full particulars upon request. Reply Box 60955, Modern Plastics.

CANADIAN INJECTION MOLDER: 20 year's experience in this field, is desirous of establishing association with American Molder of attractive Infant and Nursery line on royalty, mold rental or distribution basis. Reply Box 60355, Modern Plastics.

BRAND NEW PHENOLIC MOLDING COMPOUNDING PLANT: Output 1500 to 3000# per hour for resin and filler to be converted to molding power (phenolic). All new and in original crates. Immediately available. Plans for engineering layout and installation supervision available. W/ two Farrel Plastic 2 Roll Mills 24x60"; 2—Hammer Mills; Knife cutters; Gyrator Sifter; batch Rotary Blender; Ball Mills, etc. EVEREADY SUPPLY COMPANY, 805 Housatonic Avenue, Bridgeport, Conn. EDison 4-9471.

SUBSTANTIAL EASTERN EXTRUSION PLANT with ample capital and good sales organization is desirous of purchasing outright or merging with other extruders in strategic locations throughout the country. Replies will be held strictly confidential. Reply Box 63655, Modern Plastics.

All classified advertisements payable in advance of publication

Closing date: 28th of the second preceding month, e.g., May 28th for July issue.

Up to 60 words $10.00	Up to 120 words $20.00	Up to 180 words $30.00
Up to 60 words (boxed) $20.00	Up to 120 words (boxed) $40.00	Up to 180 words (boxed) $60.00

for further information address Classified Advertising Department,
Modern Plastics, 575 Madison Avenue, N. Y. 22, N. Y.

NEW DESIGN!

FOREMOST

Beside-the-press PLASTIC SCRAP GRINDERS

(They grind polyethylene without fluffing)

MODEL 3C-1
3 HP., throat 6½" x 12" length, 34½"; width, 30"; height, 60½"

MODEL 2A-1
1½ HP., throat 5½" x 8" length, 29¾"; width 23½"; height, 52"

MODEL 1A-1
¾ HP., throat 3¾" x 5" length, 25"; width 20½"; height, 46"

ALL THE SAME FEATURES THAT HAVE MADE US THE LEADERS IN THE INDUSTRY!

PLUS: • WIDER THROATS • STILL EASIER TO CLEAN • FULLY ENCLOSED DESIGN • TOTALLY ENCLOSED MOTORS AS OUR STANDARD • LESS FLOOR SPACE

The machine which swept the field for 2 years and revolutionized grinder design. Now available in further improved models.

FREE 10-DAY TRIAL OFFER. Test Foremost in your plant by placing 10 day trial order. Foremost Machine Builders, Inc., 52 Vanderbilt Ave., New York 17, N. Y.

The Rainville Company

National Sales Representatives

Garden City, New York, 647 Franklin Ave., Pioneer 6-7135; Franklin, Pa., Box 788, Idlewood 2-3722; Oak Park, Michigan, 21655 Coolidge Hgwy., Lincoln 6-7266; Alhambra, Calif., 2415 W. Hellman Ave., Atlantic 4-4940.

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The world-wide plastics industry points to

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MASCHINENBAU
TROISDORF WEST. GERMANY

Chemicals you live by

Why Diamond Technical Service is important to VINYL PROCESSORS

Completely equipped pilot plant is a part of the vinyl laboratory at DIAMOND's enlarged Research Center, Painesville, Ohio.

Here are two reasons: (1) our Plastic Products Laboratory evaluates and improves resins so that DIAMOND, and our customers, can make better products; (2) DIAMOND technical service is available to users, anywhere.

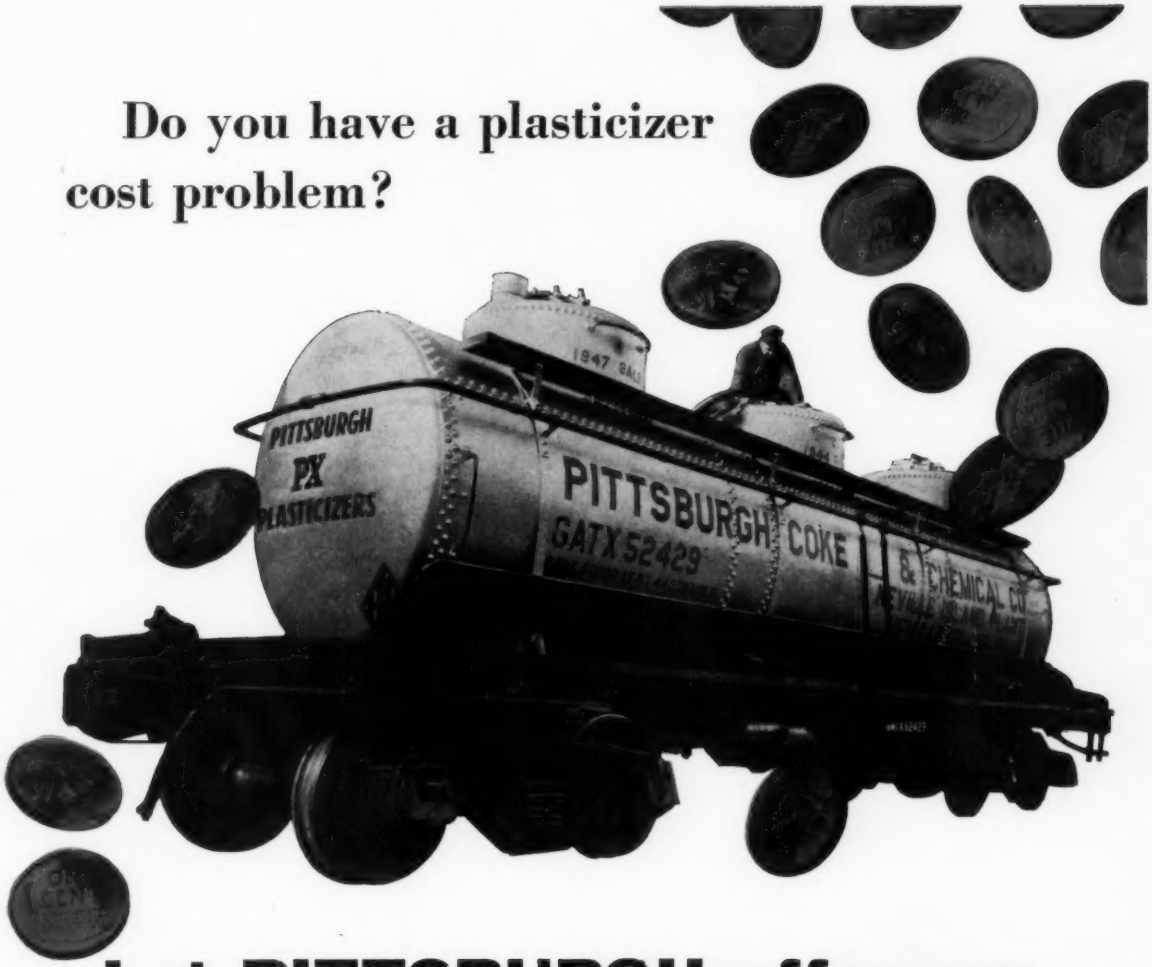
Introduced in 1954, DIAMOND PVC-50 and PVC-45 already are used satisfactorily in hundreds of formulations for extrusions, film, sheeting, and floor covering. PVC-50, suited especially for electrical insulation, has Underwriters' Laboratory acceptance, while PVC-45 offers lower temperature requirements.

Only high quality can explain quick success in a hotly competitive market. DIAMOND technical service can help you put that quality to work in your products. We're ready to work with you now. Call your nearby DIAMOND sales office or write DIAMOND ALKALI COMPANY, 300 Union Commerce Bldg., Cleveland 14, Ohio.

DIAMOND CHEMICALS

Diamond Chemicals

Do you have a plasticizer cost problem?



Let PITTSBURGH offer you some Real Savings

HERE'S a new Pittsburgh development to help you reduce plasticizer costs without sacrificing plasticizer quality. Pittsburgh now offers you a blend of one-third Pittsburgh PX-114 (Decyl Butyl Phthalate) and two-thirds Pittsburgh PX-118 (IsoOctyl Decyl Phthalate). This blend provides almost exactly the same desirable properties as DOP—but at appreciably lower cost.

Pittsburgh Coke & Chemical has developed a number of these blends as a part of its continuing effort to provide you with better plasticizers at lower cost. We'll gladly help you explore the possibility of using blends to improve quality and reduce costs in production at your plant. If such savings are possible, we'll blend to your specifications in tank truck or tank car quantities.

Let's tackle *your* plasticizer cost problems. Call or write us *today!*

LOOK AT THIS PROPERTY COMPARISON

Property comparison below is based on 100 parts resin, 54 parts plasticizer and 3 parts stabilizer in each formulation.

	DOP	⅓-114 ⅔-118
Modulus (100%)	1600	1670
Shore Hardness (10 Sec.)	78	80
Clash-Berg, T_f, oC.	—26°C	—25°C
A. C. Volatility (24 hrs./90°C)	5.0	5.0
Oil Extraction (7 days/25°C)	1.4	1.5
Gasoline Extraction (1 hr./25°C)	14.3%	12.0%
Silicic Acid Test (24 hrs./60°C)	4.5	4.4
Tensile Strength	3100	3050
Ultimate Elongation	370	380

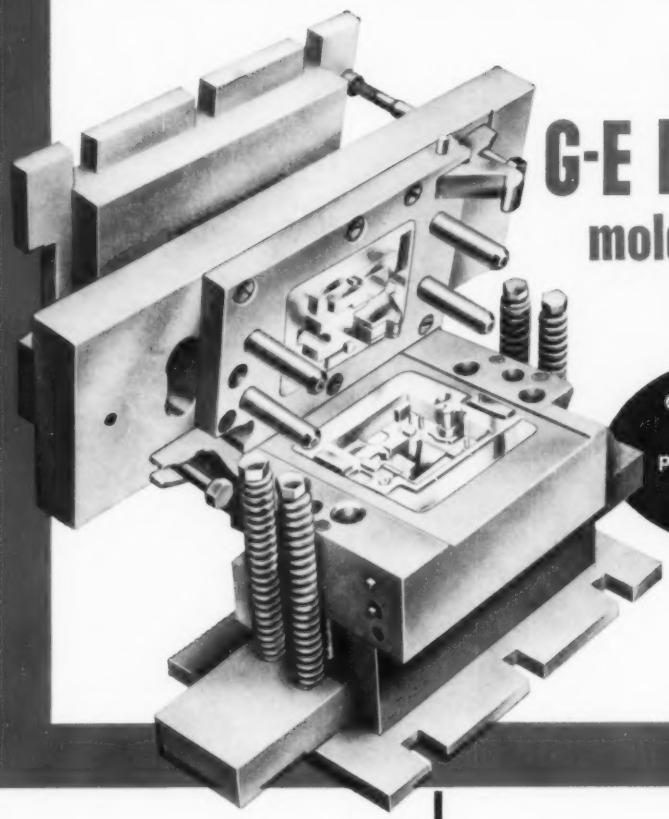
PLASTICIZER DIVISION
PITTSBURGH
COKE & CHEMICAL CO.
Grant Building • Pittsburgh 19, Pa.

W&D 5484

COAL CHEMICALS • AGRICULTURAL CHEMICALS • FINE CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

"DOWN TIME" CUT OVER 60%

with new G-E LOW-EROSION molding compounds



Gates and runners of transfer molds are particularly susceptible to erosive wear!

COMPARE!

Here is the erosion ratio of the new G-E compound compared with five other leading grades of conventional phenolic material tested by G.E.

COMPOUND	G.E.	A	B	C	D	E
EROSION RATIO*	0.15	1.0	6.3	1.7	2.6	3.3

*Erosion ratio is a numerical value expressing the measured erosive characteristics of the given compound; the lower the value the less erosive is the compound.

When conventional compounds were used, an expensive transfer mold had to be returned to the repair shop every six weeks—*because of the abrasive action of the compound.* Then the molder switched to a General Electric *low-erosion* phenolic molding compound. Result? *Fourteen* uninterrupted weeks of production—*over 60%* less down time for welding and costly refinishing!

How much is mold erosion costing *you*? It is estimated that molders lose approximately $2,000,000 each year from this cause. Through radioactive tracer techniques, G. E. has developed compounds *which may reduce this erosion as much as 60%!*

For complete information—and samples of G-E low-erosion molding compounds—just write to *General Electric Company, Section 1521-3A, Chemical Materials Department, Pittsfield, Massachusetts.*

Progress Is Our Most Important Product

GENERAL ELECTRIC